Construction Methods

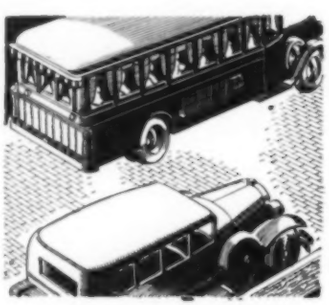
Hydraulic Rotary Drill Sinks Caisson Shafts for Chicago Building Foundation

November 1932

A MODERN BRICK-SURFACED PAVEMENT ...KEEPS THIS THROUGH HIGHWAY OPEN

North Saginaw Street, Flint, Michigan

IN the City of Flint, Michigan —known for its industrial growth and progressive enterprise—a Modern Brick-Surfaced Pavement keeps this through highway open. Open to the caravans of commerce —the constant flow of motor trucks and buses; to pleasure vehicles of all descriptions, passing and re-passing; and to an inter-urban trolley system whose tracks must be kept clear 24 hours a day. All the needs of a bustling city thoroughfare, that is at once an important segment of a vast transportation network—adequately met.



Smoothness, long-life and low cost per year of service! These are the qualities on which the builders of modern roads depend to meet the ever-increasing demands of highway traffic, assuring to the public uninterrupted service. This means freedom from excessive maintenance charges and freedom also from the public nuisance of a road closed for repairs.

This fine stretch of pavement was built of METRO block in 1928; and possesses all those qualities that commend themselves to the builders of modern good roads. It is these qualities that account for the established popularity of Modern Brick-Surfaced Pavements.

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BRICK PAVEMENTS

Tune in on the Good Roads Program . . . Monday evenings at 8 o. m. over WTAM (Cleveland)

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The Editor Notes—

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

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McGraw-Hill Publishing Company, Inc.
330 West 42d St., New York, N. Y.

To Stimulate Business Recovery

A COMMITTEE on Industrial Rehabilitation, organized recently by the banking and industrial committees of the twelve Federal Reserve districts, has inaugurated a national program to relieve unemployment and stimulate business recovery by accelerating the replacement of obsolete machinery, equipment and plant facilities throughout the country. As explained by its chairman, A. W. Robertson, chairman of the board of the Westinghouse Company, the object of the committee is to set in motion a succession of orders for improved equipment and machinery that will extend, in their effect on employment and spending, from the factory back to the farms, the forests and the mines. Every order starts a wave of work required in the production, processing, transportation, installation and sales of materials and services that is felt through all branches of business.

If industry will proceed at once, for reasons of sound self-interest, to put its house in order and to remedy, through modernization, the run-down condition of its productive equipment, employment will be created for hundreds of thousands of workers in the "capital goods" industries. In addition, it will bring back on the pay-roll hundreds of thousands of workers in industries that furnish the parts, raw materials and services bought by these machinery and equipment manufacturers. In carrying through the plan there is need of immediate action to restore a sound program of capital investment.

Health Protection for Hard-Rock Drillers

Danger of silicosis, a disease of the lungs resulting from exposure to dust in hard-rock mining, has long been recognized. More recently has come a realization of the hazard suffered by workers in open excavation of hard rock. An examination of 208 rock drillers, blasters and excavators in New York City, where the rock is a hard schist containing a large proportion of free silica, showed evidence of silicosis in 118 men, or 57 per cent of the total. Among the 72 men who had worked only in open excavations, 30 men, or 42 per cent, had developed ante-primary or more advanced stages of the disease.

Silicosis is caused by inhalation of fine dust containing free silica. The health hazard increases with the silica content of the dust and with its concentration in the atmosphere. Fine particles constitute the greatest menace to the lungs. Injury is progressive in nature, increasing with the length of exposure and continuing even after the worker leaves his dusty occupation. Among the workers on open excavation examined in New York City, the ante-primary condition was prevalent after 5 years' exposure; 10 years' exposure produced first-stage silicosis and second and third stages were found in high proportion after 20 years. Silicosis generally is followed by tuberculosis of a fatal type.

Greatest concentration of dust in rock excavation occurs at the drills. Numerous past efforts to control this dust have been only partially successful. Within the last two years, George S. Kelley, Theodore Hatch, and their associates have developed dust-removal equipment (described in the September number of *Construction Methods*, p. 33) which actual dust counts in the field indicate to be effective in reducing the concentration at the drills below the hygienic safe limit, removing the dangerous invisible dust as well as the innocuous visible particles. Success of their experiments leads to the hope that a practical means of combating silicosis soon will be ready for general application.

Without waiting for official action, contractors ought to investigate the possibilities of dust removal. The cost is not excessive. On a large foundation job in New York City the total added cost was only 1.05 per cent.

R.F.C. Approves Project Loans

ALTHOUGH handicapped by a slow start, substantial progress is now being made by the Reconstruction Finance Corporation in extending credit to various types of public works construction that come under the terms of the act. At this writing loans amounting to $125,000,000 have already been made. In addition to the projects thus financed by direct loans will be many others that will be financed through normal investment channels under the spur of R.F.C. competition. Then, too, $320,000,000 worth of Federal Government construction has been authorized and is getting under way, making, in all, nearly $450,000,000 which has been released for capital investment under provisions of the Emergency Relief and Construction Act alone.

Cooperation of local interests is absolutely necessary if the Reconstruction Finance Corporation is to put to use the maximum amount of the $1,500,000,000 fund provided for self-liquidating public works. It is good news to learn that the corporation, in an effort to stimulate applications for loans on small as well as on large projects, recently invited thirty-seven well-known engineers to assist local applicants throughout the United States in submitting their proposals in proper form for quick action.

A Journal at Work

A MAJOR function of the industrial journal is to promote the technical progress of the field it serves. Thus *Construction Methods* seeks to reflect the progress of construction practice, to bring to its readers each month a representative selection of good ideas gathered from all kinds of jobs all over the land.

It is our hope that these will be helpful to our readers and they may be able to apply them to their advantage on their own work. Every so often we are so fortunate as to have impressive evidence of our success in this effort. The other morning we received from Mr. Louis P. Corbetta, of the Corbetta Concrete Corporation, a letter from which the following is extracted:

> "Those, in our organization, who participate in the "shaping up" of our bids for new construction work are perfectly ready to acknowledge the assistance *Construction Methods* has given us toward more intelligent, aggressive bidding.
>
> "As an example, the writer personally recalls that the basic idea for a travelling scaffold, which we used with great success on the George Washington Bridge, was gleaned from photographs in your magazine. When we tell you that the successful bidding of this deck contract for the longest suspension bridge in the world depended on the most economical solution of the concrete form stripping problem (all other factors being fairly "cut and dried") you can readily understand why the writer, for one, is so enthusiastic about reading *Construction Methods*.
>
> "Again we find your detailed "Step-by-Step" descriptions of specific minor operations of great help, sometimes in locating weaknesses in our own handling of like general methods. Then, too, as a man and machine hour guide to production costs, they have been very helpful.
>
> "So, when we say, *Construction Methods* has contributed its share to us in a real tangible money value sense, we're reasonably sure we are merely echoing the many other contractors who read your very worthy monthly regularly."

From all of which it is reasonably evident that *Construction Methods* offers brass-tacks value to any alert construction man who will take the trouble to read it. And is it not equally evident that a readership founded on so practical a basis must be of unusual value to the advertiser? Is it not obvious that any constructor so interested in methods and processes will be equally interested in the materials and equipment required to apply them?

All in all this is an excellent example of a first-grade industrial journal at work and making good at its job.

We are grateful to Mr. Corbetta for taking the trouble to write us about it.

Willard Chevalier

Publishing Director.

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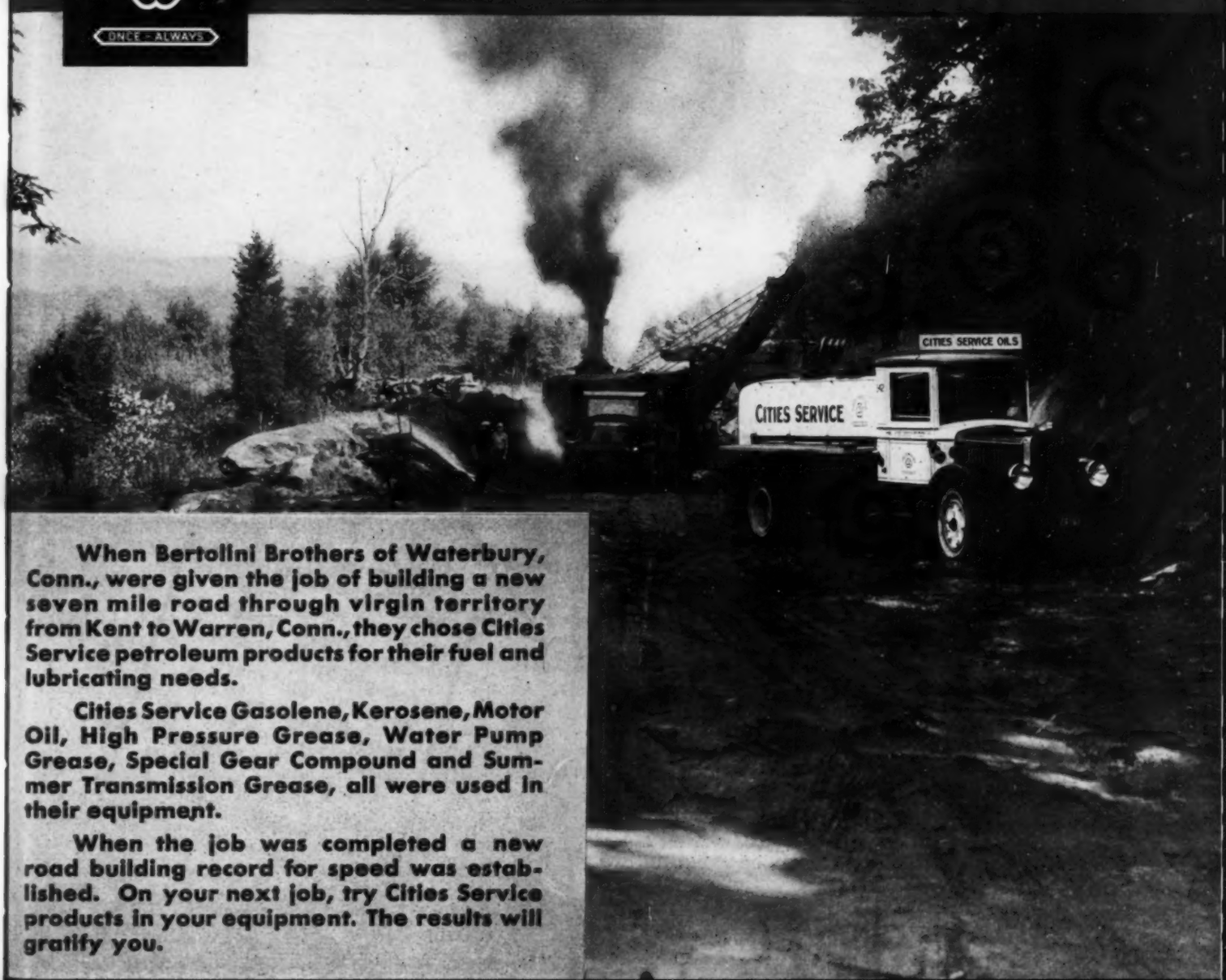
A new record was established in building this road, and

CITIES SERVICE

helped the Contractor accomplish this feat

CITIES SERVICE OILS

ONCE - ALWAYS



When Bertolini Brothers of Waterbury, Conn., were given the job of building a new seven mile road through virgin territory from Kent to Warren, Conn., they chose Cities Service petroleum products for their fuel and lubricating needs.

Cities Service Gasolene, Kerosene, Motor Oil, High Pressure Grease, Water Pump Grease, Special Gear Compound and Summer Transmission Grease, all were used in their equipment.

When the job was completed a new road building record for speed was established. On your next job, try Cities Service products in your equipment. The results will gratify you.

"IF IT'S CITIES SERVICE—IT HAS TO BE GOOD!"

Cities Service Oil Company Crew Levick Company Cities Service Refining Company
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ON THE LEVEE

SINCE "Caterpillar" Tractors first went on the Mississippi Levee in 1921, each year has seen a steady increase in the number of them engaged on this stupendous task. Today, as "Caterpillar" Tractors are constantly added to levee fleets, their arrival excites no comment—it's accepted as the natural thing. Experiments with other equipment—tests of price versus quality—arouse curiosity, comment, passing interest. "Caterpillar" continues as the accepted standard.*

* September deliveries on the Mississippi Levee put the total number of "Caterpillar" Tractors engaged on that job well over the 500 mark—a complete survey showed a total at that time of less than one-fourth that many tractors of all other makes combined.

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REG. U. S. PAT. OFF.

TRACTOR

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Track-type Tractors Road Machinery

Combines

(There's a "Caterpillar" Dealer Near You)

Prices — f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

The Ridge Road Alternate.—A 27 mile road now being built between Los Angeles and Bakersfield, Calif. Every mile of grading on this road was tough going, involving big fills, deep cuts, channel changes, and slides. One cut in Section 1 is said to be the biggest in the history of road building in the U. S. This is one of Morrison-Knudsen, McDonald and Kahn's two Link-Belt shovels on this job.

Consider the Cost of Operation

DOES your equipment meet the competition and narrow profit margins of today's markets? Lower operating and maintenance costs may be just the wedge that will put you in the running.

The Link-Belt Shovel-Crane-Dragline is the kind of equipment that will help eliminate losses and slowness in completing the hard jobs.

James DeGood, Grand Rapids, Michigan, recently said regarding a hurry job, "I could finish this job in one half the time if I had a Link-Belt on it." That certainly would have meant something in profits.

We quote him further, "During the past year I have rented at least six different makes of shovels. Not one of them can begin to handle as much dirt as my Link-Belt. It will keep nearly twice as many trucks moving, and with much less expense.

"I purchased my first Link-Belt in May, 1928, and the first real repairs were made on it this year. This, in spite of the fact that the machine has operated steadily every day on all types of work. I use it on the tough work."

Let a Link-Belt carry the burden of making a profit on *your* next job. From ¾ to 2½ yds. capacity, heavy duty built.

LINK-BELT COMPANY 4626
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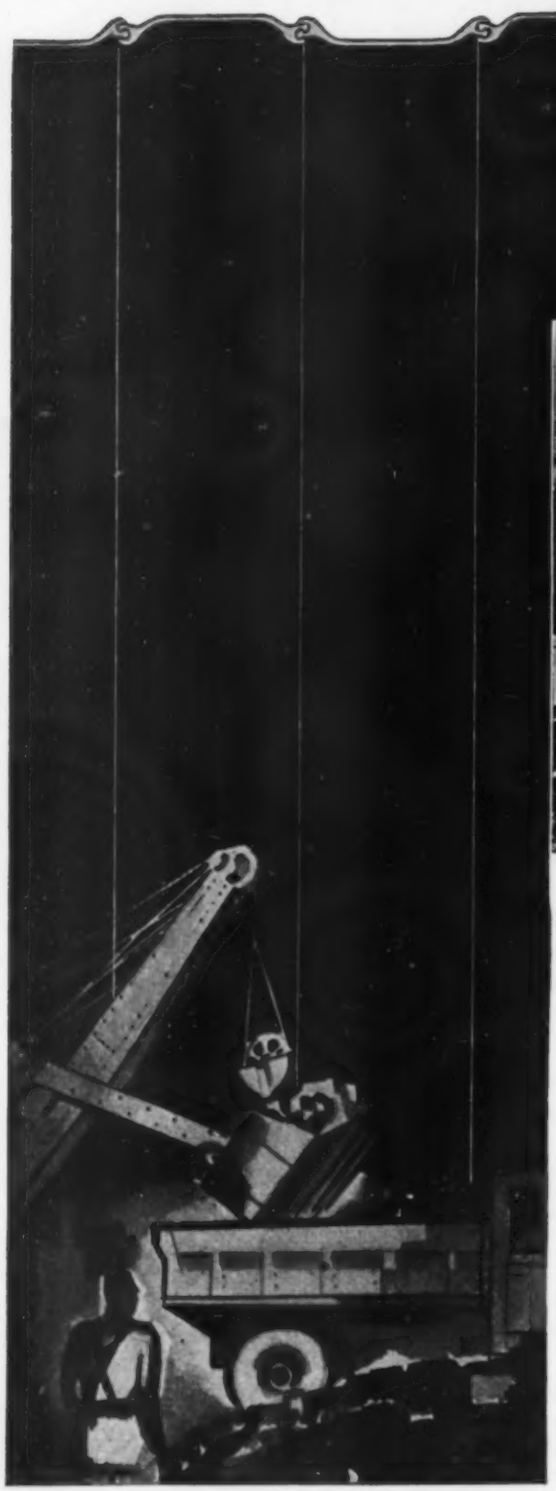
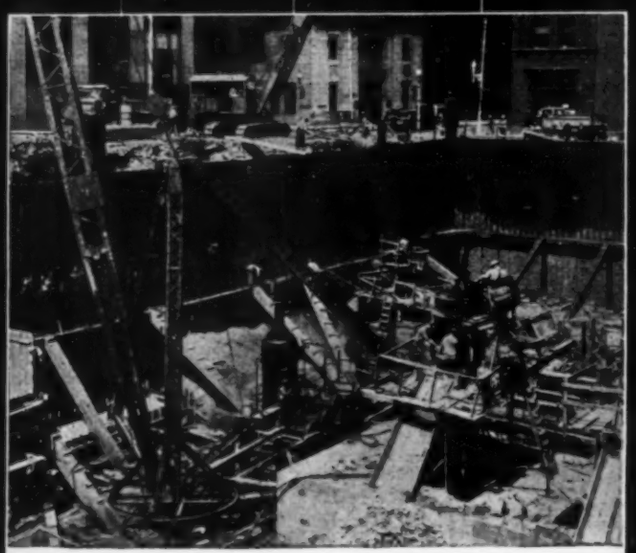
LINK-BELT SHOVELS— CRANES— DRAGLINES

WALLS OF STEEL





Carnegie Steel Sheet Piling in foundation of Gulf Building, Pittsburgh

FOR all types of foundation work, particularly where adjoining foundations and streets must be protected, walls of steel sheet piling are highly efficient. A wealth of experience in the use of piling makes the services of Carnegie engineers of real value to you in the solution of your problems. Feel free to take advantage of their services.

US STEEL

CARNEGIE Steel Sheet PILING

Product of CARNEGIE STEEL COMPANY, Pittsburgh, Pa., *Subsidiary of United States Steel Corporation*

207

Greatest digging ability
PER POUND OF WEIGHT

A bantam-weight shovel with the ruggedness of a dreadnaught . . . that's what contractors have wanted. Now you can get it in this new Bucyrus-Erie 16-B ½-yard . . . more hustling, tenacious digging ability per pound of weight than has ever before been built into *any* excavator.

Here is power unhampered by deadweight, speed set free by easy operation, durability assured by special steels, complete accessibility and simple design. The 16-B is a challenge to low priced dirt, a money maker on every job requiring a light, speedy machine.

Send for complete information on the 16-B. It is a machine which sets new standards of balanced value in the excavating industry.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis.

562

29,700 lbs.
SHIPPING WEIGHT

6 cyl. 54 H. P. Gasoline Engine

New speed and power • New weight distribution . . . No dead counterweight • All clutches interchangeable • Welded boom and sticks • No center pintle • Unit assembly • Priced to make it the greatest ½-yard value ever offered.

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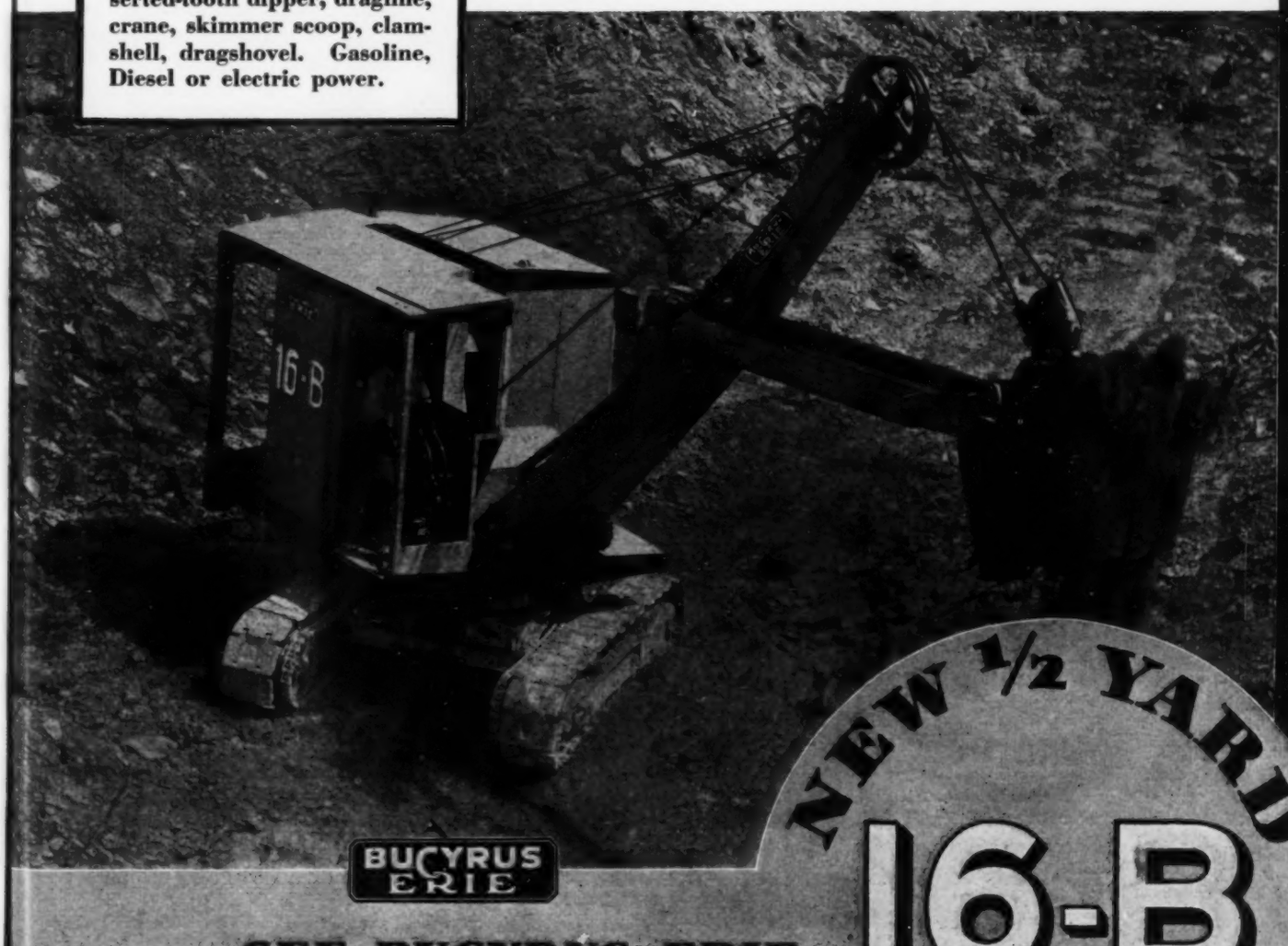
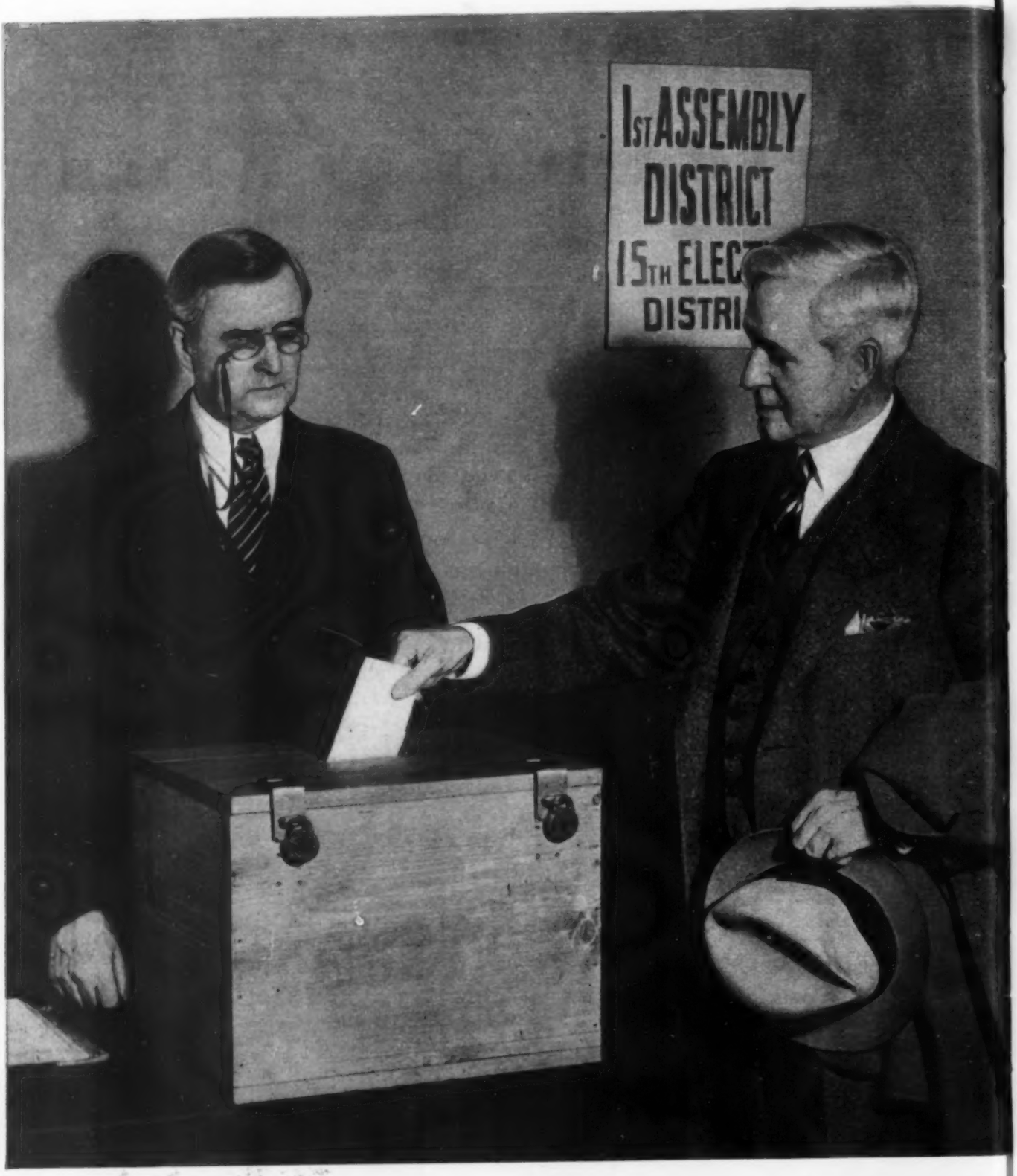
Chain crowd shovel with inserted-tooth dipper, dragline, crane, skimmer scoop, clamshell, dragshovel. Gasoline, Diesel or electric power.



MOST FOR YOUR MONEY

SEE BUCYRUS-ERIE



ROEBLING

Showing one piling wall and, at the left, the old wooden wharf which the new 60-ft.-wide pier replaces. Bethlehem (Lackawanna) Deep Arch Section DP 165 in lengths of from 30 to 40 ft. was used on this job.

HARD GRAVEL--BOULDERS proved no obstacle to BETHLEHEM (Lackawanna) PILING

When it was decided to build a new pier at Station B of the Philadelphia Gas Works Company, difficulty was anticipated because of the hard gravel bed of the Delaware River at that point, and careful study was given to the selection of the piling.

The decision to use a steel sheet piling structure was based largely on the results of driving test piles. While the timber piles that were tested could not be driven to the required depth because of their tendency to "broom" and splinter, Bethlehem (Lackawanna) Steel Sheet Piles were driven in the hard river bed to the required penetration.

The use of Bethlehem (Lackawanna) Piling was fully justified by the results obtained. The entire 425 tons of piling required for the job were driven without difficulty; only two boulders were encountered which the piling was unable to split, and they were readily rolled out from beneath the piling by dredging. Further, using Bethlehem (Lackawanna) Piling instead of following the type of construction originally contemplated resulted in a very substantial saving.

If you are planning a job that involves the retaining of earth or water, either in permanent or temporary work, perhaps the use of Bethlehem (Lackawanna) Piling would help to simplify your problem and to lower the cost of the project.

The completed pier, built at Station B of the Philadelphia Gas Works Company.
Kolyn Construction Company, Contractor.

KALMAN STEEL CORPORATION

Subsidiary of Bethlehem Steel Corporation

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Construction Methods

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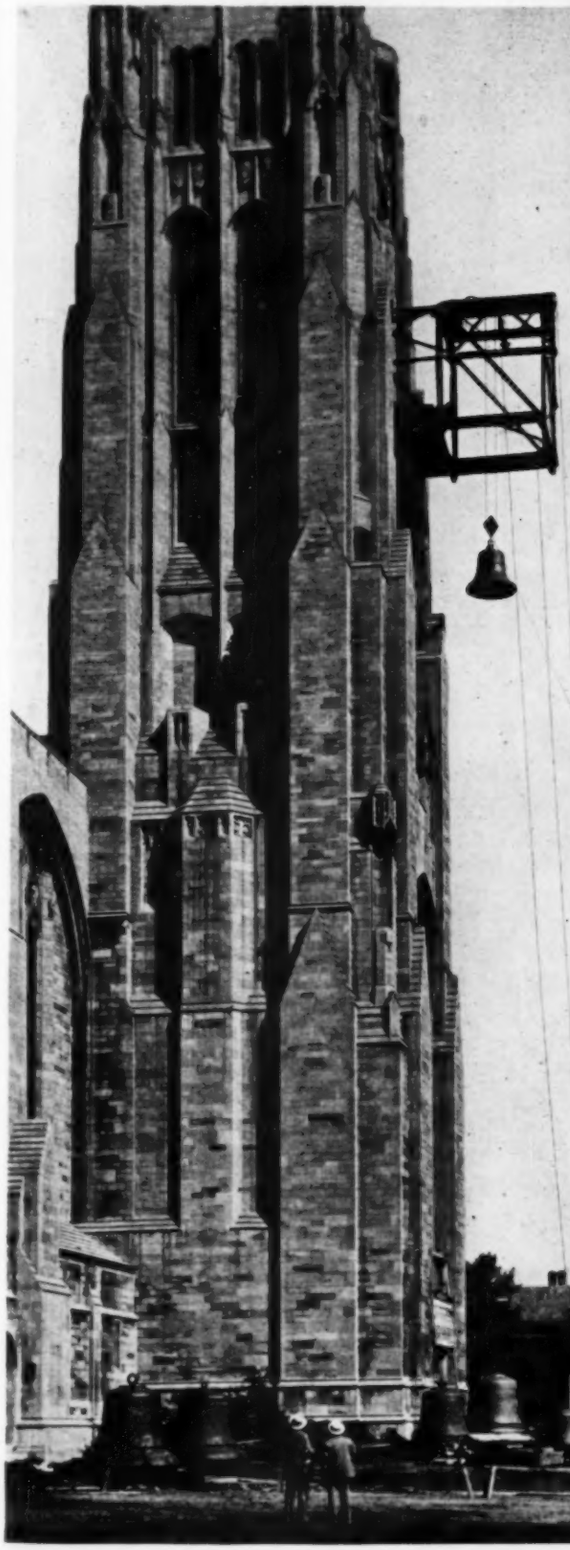
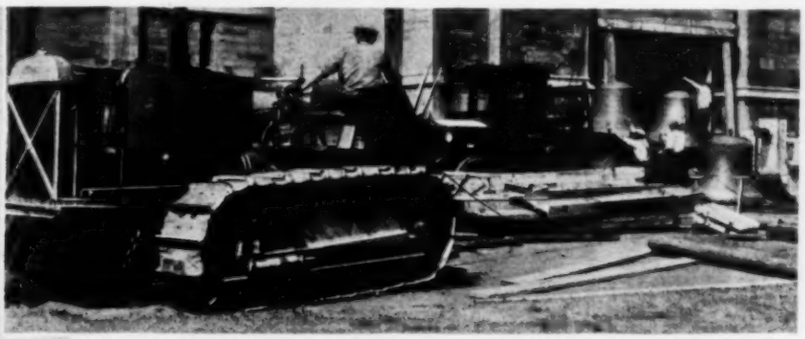




TRACTOR-HOIST OPERATOR, running machine in second gear, raises 18½-ton bell 180 ft. in 6 min., 35 sec., and lands it on outrigger car without a jar.

Tractor Hoist Raises BELLS FOR CARILLON

DELICATE and precise handling of heavy, brittle, cast-metal units was required of the Pennoyer Merchants Transfer Co., Chicago, in erecting 72 bells varying up to 18½ tons in weight for the carillon in the chapel tower of the University of Chicago. The erection company first constructed a cantilevered steel-frame outrigger 180 ft. above the ground. Hoisting sheaves were placed in the upper part of the outrigger, and a movable car traveled on the lower members.

After erecting an 80-ton steel framework for the carillon inside the tower, the contractor raised the bells individually by means of a Caterpillar 60-hp. tractor equipped with a two-drum hoist, moved them into the tower on the outrigger car, and hung them in staggered positions at three levels. The heaviest bell and two others were lowered 30 ft. from the outrigger and suspended in yokes on the framework. Total weight of the 72 bells was 206 tons. Fred Gamen was rigger foreman in charge of the work, under J. X. Galvin, president and general manager.

STEEL-FRAME OUTRIGGER *(left)* 180 ft. above ground carries sheaves for hoisting 72 bells of carillon.

This Month's
"News Reel"

Keystone Photo

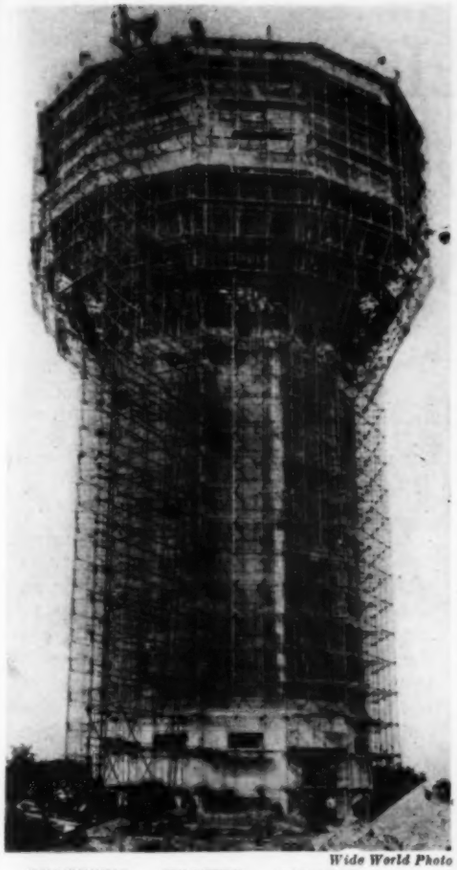
STEEL ERECTORS of Post & McCord, New York City, erection subcontractors, raise flag on improvised mast to celebrate topping out of skeleton frame of 69-story RCA building *(right)*, largest unit of Rockefeller Center development, New York City. Structure contains almost 2,100,000 sq.ft. of rentable floor area, exceeding that of any other office building. Hegeman-Harris Co., Inc., of New York City, general contractor.

Acme Photo

Wide World Photo

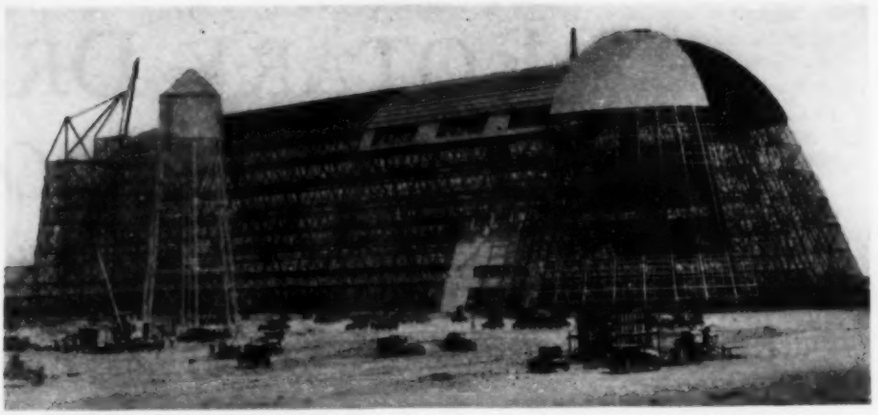
CORNERSTONE of new Post Office Department building in Washington, D. C., is laid by President Hoover with same trowel which George Washington used in laying cornerstone of U. S. Capitol.

SOUTH ABUTMENT OF MADDEN DAM, Canal Zone, had been excavated and made ready Sept. 1 for placing of concrete, which now is going forward at rate of 600 yd. per shift. Work within cofferdam is being rushed to permit diversion of Chagres River in January. W. E. Callahan Construction Co. and Peterson, Shirley & Gunther are contractors.

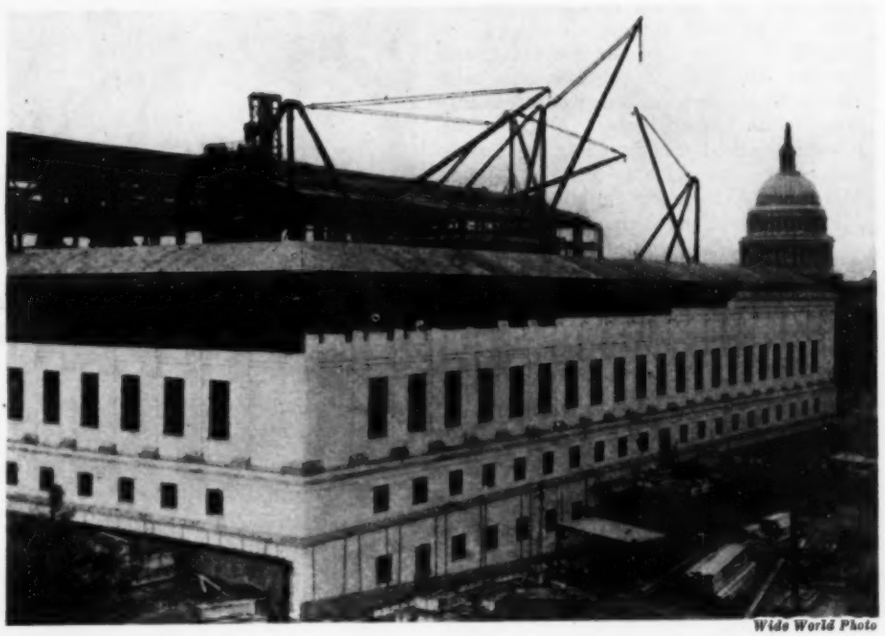


Wide World Photo

ENGLISH WATER TOWER under construction at Great Yarmouth rises to height of 162 ft. and has capacity of 784,000 gal.



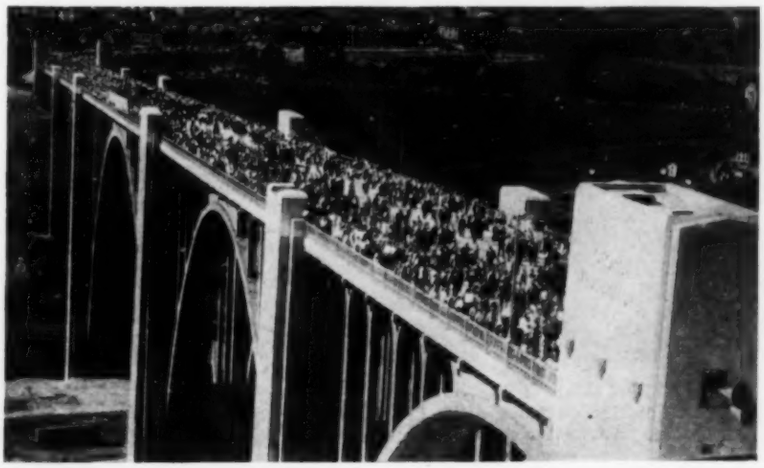
AIRSHIP DOCK to house giant dirigible, "Macon," sister ship of "Akron," assumes final outlines with completion of steel frame at Sunnyvale, Calif. Dock is similar to one erected at Akron in 1929, semi-ellipsoidal in shape and about 1,200x325 ft. in principal ground dimensions.



Wide World Photo

SUPREME COURT BUILDING *(right)* rises on its site just east of Capitol, Washington, D. C. Structural frame contains 4,900 tons of steel. David Lynn is government architect in charge of all capital structures. For this building Cass Gilbert, Cass Gilbert, Jr., and John R. Rockart are architects. George A. Fuller Co. is general contractor.

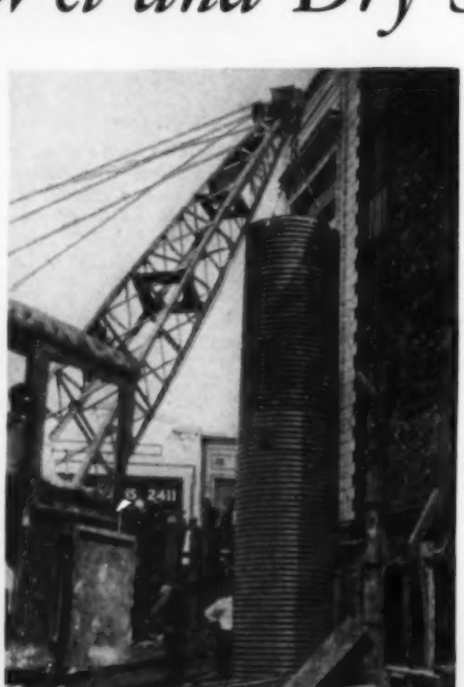
GEORGE WESTINGHOUSE BRIDGE *(below)* across Turtle Creek Valley at East Pittsburgh, Pa., is officially dedicated at opening of 5-mi. Lincoln Highway relocation eliminating one of country's worst traffic bottlenecks. Booth & Flinn Co., of Pittsburgh, built structure. A. W. ROBERTSON *(left)*, chairman of board of Westinghouse Electric & Manufacturing Co., delivers dedication address.



ROTARY DRILLS
Speed Caisson Shaft Construction in Wet and Dry Soil

TWO types of rotary drills have been developed within recent years to sink caisson shafts rapidly in certain kinds of soils. A wet-process caisson rotary, described in *Construction Methods*, April, 1930, pp. 34-37, was designed for the purpose of sinking caissons in unstable, water-bearing soil without loss of ground. This purpose is attained by leaving a liquid core in the hole until after the casing has been placed. The wet-process rotary, developed by Charles L. Powell of the Caisson Contracting Co., New York City, has been used with success on numerous installations in the United States. On a recent job this method was used for the installation of some piers of the Illinois Motorists' Association Building at South Michigan Ave. and 24th St., Chicago.

SECTION OF ROTARY STEM, 10 ft. long and weighing 3,000 lb., is handled by crawler crane in extending or dismantling drill stem.



IN HYDRAULIC PROCESS, after rotary drill stem and bit have been removed from hole, crane works down corrugated metal casing through liquid muck to bedrock.

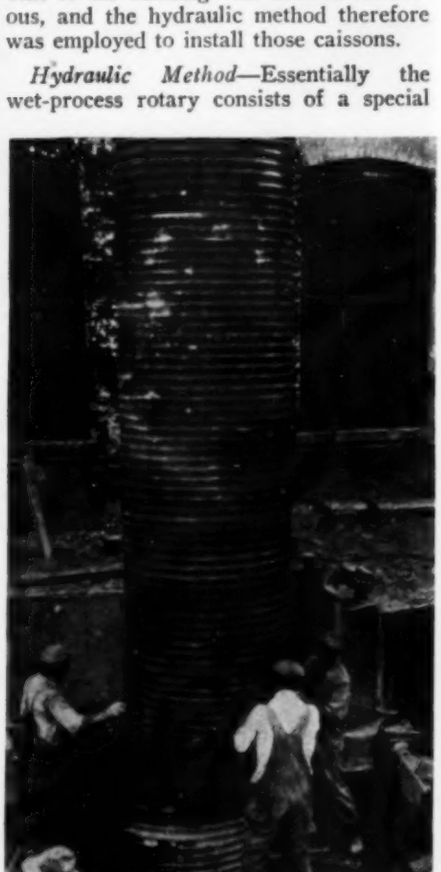
A dry-process caisson rotary was developed by The Gow Company, Inc., New York City, for the purpose of sinking caissons in dry or pre-drained soil, using whatever type of casing might be economically adapted to the particular size and depth of the caissons and to the cohesive or non-cohesive character of the soil. This rotary has been used for the installation of caissons in many parts of the country over the last six years. Its use, last winter, for installing the caissons for the new Detroit Post Office was a conspicuous example of its high speed, utility and economy. On that work it cleanly excavated the caissons to accurate dimensions and to a depth of about 120 ft. so rapidly that the lagging was placed after the completion of the caisson execavation and before the clay had an opportunity to squeeze.

Wet Process

The foundation of the Illinois Motorists' Association Building in Chicago involved the sinking of 66 caissons about 65 ft. deep to bedrock; 18 of these caissons were only 6 ft. from the wall footing of an adjoining two-story building. Ground conditions on the site consisted of: (1) 10 ft. of dry sand, (2) 16 ft. of quicksand, (3) 12 ft. of stiff clay, (4) 21 ft. of soft blue clay, (5) 5 ft. of hardpan, (6) limestone bedrock.

Although the usual "Chicago" lagging-and-ring method of installing the forty-eight caissons most distant from the adjoining building was considered by the contractor to involve no serious risk to the adjoining building through loss of ground in penetrating the quicksand, its use for the 18 caissons immediately adjacent to the building was deemed hazardous, and the hydraulic method therefore was employed to install those caissons.

Hydraulic Method—Essentially the wet-process rotary consists of a special

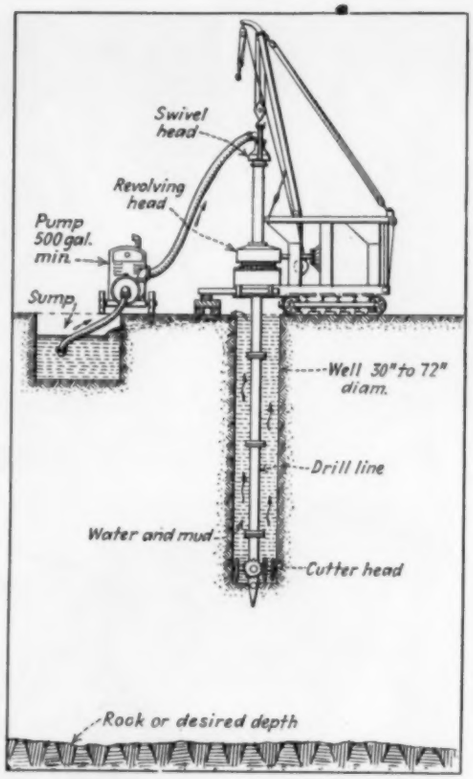


BOLTED SLEEVES splice sections of corrugated casing and develop joint strength to permit use of casing as reinforcement.

bit or cutter-head on the lower end of a long rotating hollow stem through which liquid is pumped. The liquid mixes with the cuttings and keeps the caisson filled with a fluid muck having a specific gravity and head greater than the water in the ground, thus holding the walls and bottom of the caisson under sufficient hydrostatic pressure to prevent any infiltration or caving. Sections are added to the rotating stem as the sinking of the hole progresses. The excess liquid, carrying some of the solids, drains away from the top of the caisson to a sump from which pumps return it, under pressure, to the hollow rotary stem.

After the caisson has been carried to bedrock by this method, the rotary stem and bit are removed and the caisson is lined with corrugated steel casing or with plain steel casing which may be either withdrawn as the caisson is concreted or left in place for use as reinforcement. In the latter case the casing, with proper joint development, is used in lieu of spiral and vertical reinforcement.

After the casing has been set, the solids which have not been carried out by the circulating fluids settle to the bottom of the caisson and are removed by a crane with a mud scow or an orange-peel bucket. If the casing is sealed in an impervious bottom, the liquid may then be pumped out and the caisson bottomed by hand in the open. If the caisson has to be belled out in a previous bottom (a condition which existed on the work described in *Construction Methods* of April, 1930), an airlock is attached to the top of the casing, and the caisson is bottomed out under air pressure. However, if the caisson shaft does not have to be belled out, but has to be bottomed under pervious conditions equivalent to a boulder formation overlying ledge, the lower section of the casing may be utilized as a shot core barrel and may be rotated while the upper sections of the casing remain fixed against rotation, thus drilling the entire casing through the boulders into the ledge. The shaft is then pumped out and bottomed in open.



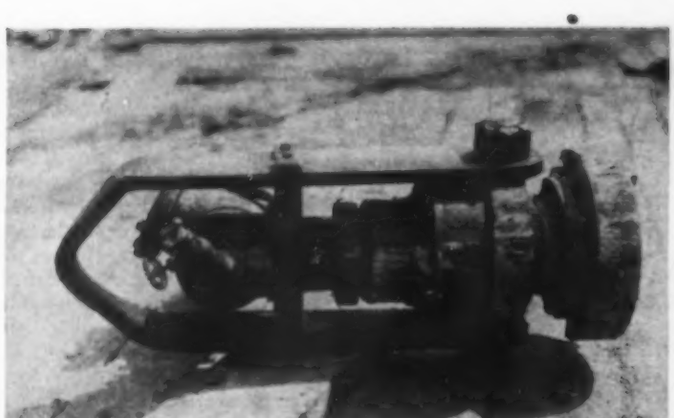
HYDRAULIC METHOD provides hydrostatic pressure in caisson excavation by pumping liquid stream through hollow drill stem to form fluid muck in hole.

Rotary Machine—The hydraulic rotary is a crawler-mounted A-frame derrick having a heavy housing at the front end for the worm reduction gearing which rotates the hollow stem. This gearing is driven by a high-power gasoline motor. The hollow rotating stem is made up of short, heavy sections with bolted connections and matched joints. The sections are slotted on opposite sides to engage with the keys of the worm gearing.

A water swivel at the top of the rotating stem has a connection for a hose from the circulating pumps. This swivel is removed and replaced each time a section of hollow stem is added. Usually a crane serves the rotary, lifting the stem sections and handling the various parts

HOUSING for revolving head of hydraulic rotary drill is mounted at front end of crawler A-frame derrick.

AFTER CAISSON HAS BEEN EXCAVATED, hollow drill stem is dismantled by sections, and machine is moved back from hole to allow workmen to unbolt cutter head.



SWIVEL HEAD used at top of hollow drill stem for hose connection from sump pump.

CUTTER HEAD for drilling hard ground has two reamer arms, one equipped with scarifier teeth and other with toothed sprockets. Liquid discharges from openings near point.

as required. On the Chicago job referred to above, two circulating pumps supplied about 600 g.p.m. at a pressure of 60 lb. per square inch.

Cutter Head—The bit or cutter-head is bolted to the lower end of the rotating stem. One of the photographs shows the type bit used for drilling hard ground. This bit consists of a hollow casting with two reamer arms at right angles to each other and to the bit. A drill point is keyed to the lower end of the hollow casting, which has circular openings near the point for the discharge of liquid. The lower reamer arm is equipped with toothed sprockets which turn on the round shaft; the upper has scarifier teeth bolted to it. Adjustment can be made in the length of the reamer arms shown in the photograph for cutting wells up to 6 ft. in diameter. Other types of bits are used for various conditions. The Caisson Contracting Co. is now building equipment for the installation of caissons up to 10 ft. in diameter.

Progress—According to John J. Gault, mechanical engineer of the W. J. Newman Co., which installed the caissons on the Chicago job, the average progress of the hydraulic rotary on that work was about twice as fast as by hand. This speed, with improved gear drive recently developed, should be materially increased.

Dry Process

An entirely different type of drill is the bucket rotary developed by The Gow Company, Inc. The sinking of 108 caissons (4 ft. 9 in. to 7 ft. 3 in. in diameter and 120 ft. deep) for the new Detroit Post Office at the average rate of about two complete caissons every three shifts or about 80 ft. per shift was a demonstration of its efficiency. This rotary was designed for use in either cohesive or non-cohesive soils which are dry or can be made dry by pre-drainage. Given the proper ground conditions, the bucket rotary can sink caissons at an extremely rapid rate, having produced over 200 lin.ft. of finished caisson per shift. The production of the rotary is dependent not only on the ground conditions but also on the average depth of the caissons

REVOLVING HEAD of rotary machine drives hollow drill stem through worm reduction gearing by power from gasoline motor.

IN DRY PROCESS, rotary drill equipped with tubular telescopic shaft having muck bucket at lower end excavates caisson and brings up spoil to dump in truck.

and on the type of lining used. Chiefly on account of the hoisting time, it drills faster in the higher levels than in the lower levels. For instance, its excavating speed on a 7 ft. 3-in. diameter caisson 120 ft. deep on the Detroit Post Office site varied from 24 ft. per hour near the top of the hole to 12 ft. per hour at the bottom.

The Detroit Post Office covers an area 250x270 ft. bounded by Fort, Shelby and Wayne Sts. and Lafayette Boulevard. The general excavation extended to El. 600. In sinking the caissons from this level to hardpan bottom at El. 482.5, the rotary penetrated: (1) 6 ft. of yellow brick clay, (2) 54 ft. of stiff blue clay containing about 11 per cent water, (3) 23 ft. of black gummy clay containing about 14 per cent water, (4) 34½ ft. of solid dark blue clay containing about 9 per cent water. At various levels, horizontal seams and lenses of wet sand were encountered which varied from a few inches to as much as 10 ft. thick. These conditions were practically uniform over the entire site.

Bucket Rotary—The bucket rotary is a crawler-mounted, full revolving, electric-powered crane equipped at the front end with a rotary table which rotates a sectional, tubular, telescopic shaft splined inside and out and carrying, at its lower end, a muck bucket, equipped with a set of reamers, for excavating and bringing up the spoil. This rotary is built on a Marion, type 450, gas-electric shovel chassis. On the Detroit work, an electric motor, taking current from a cable entering the cab through the king pin, drove a generator which furnished power to the various motors driving the hoists and the rotary table. The rotary motor is mounted on a platform supported by a structural bracket on the heavily reinforced boom. The boom, fixed in position, carries the hoisting line of the telescoping shaft, which is called the "Kelly."

Five Kelly sections were used on the Detroit work, three being 24 ft. in length

and two 32 ft. in length. Each Kelly section is made from a high-strength steel forging which is bored out and machined so that the keys and the tube are one solid piece of metal. The keys of the outermost of the five Kelly sections engage with the keyways of a short driving section (about 3 ft. long), to which is welded a bevel-gear-collar transmission unit. On the Detroit work the average rotary speed under load was about 10 r.p.m.

Muck Bucket—Attached to the lower end of the innermost Kelly section is a circular, straight-side, bottom-dump excavating bucket. The bucket used on the Detroit work was 4 ft. in diameter and had a ¾-yd. capacity. Fastened to the bale at the top of the bucket are two adjustable reamers which cut the caisson to the desired diameter. The same size bucket may be used in digging caissons of various diameters, the adjustment being made in the length of the reamers.

The bottom-gate dumping mechanism of the bucket consists of two hinged leaves to which are attached cutting knives having a pitch dependent on the character of the soil to be excavated. With clockwise rotation the sloped cutting knives on the bottom of the bucket not only cut into the soil but also guide the muck into the interior of the bucket. The opening between the door leaves in the bottom of the bucket is large enough to admit boulders up to 7 in. in diameter, the handling of which may be facilitated by supplementing the sloped cutting knives with teeth. The leaves of the bucket, when in cutting position, are held closed by latches.

When the bucket is hoisted from the caisson, it engages with a latching ring under the rotary table platform, as shown by one of the photographs. This latching ring holds the bucket while the machine swings over the dump truck standing alongside. The operator then releases the latch, permitting the leaves of the bucket to swing down on their hinges and drop the load into the truck.

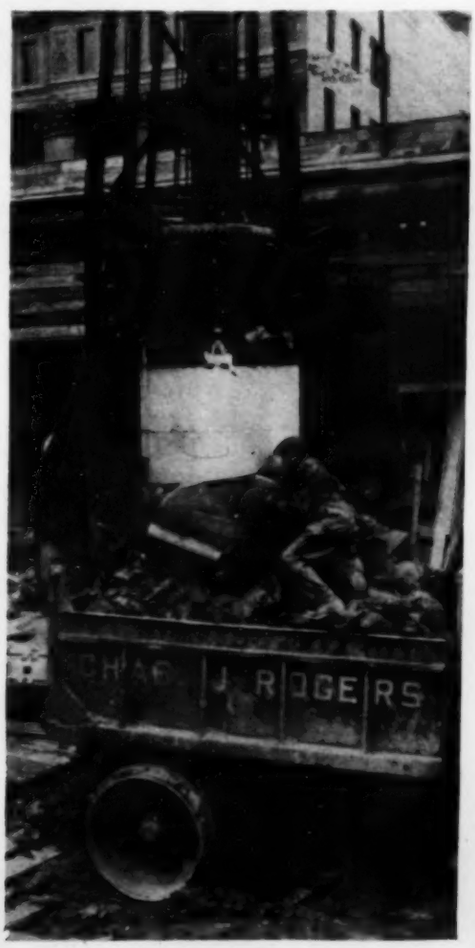
TO REMOVE BOULDERS from caisson excavation without placing lagging, contractor devises cage of heavy wire screen on steel frame which protects workmen lowered into hole from falls of earth.

Removing Boulders—Boulders were encountered in almost every caisson on the Detroit work. These boulders varied from small ones, which could enter the bucket, to large stones weighing as much as 1,000 lb. The boulders which could not enter the bucket had to be removed from the excavation by hand. To accomplish this removal, it was necessary for a crane to lower one or two men into the caisson.

All the caissons were lined upon completion of the excavation with lagging made up and placed in circular cylinders, or barrels, consisting of 2x6 in. x 16-ft. tongue-and-groove lagging pre-assembled on solid welded rings. When a boulder was encountered in the process of drilling a caisson, cylinders of lagging were placed in the hole to protect the men before they were lowered to remove the boulder. The usual procedure consisted in moving the rotary over to another caisson, using a crane to set the lagging in the hole containing the boulder, removing the boulder by hand, and withdrawing the lagging with the crane. The operation was so smoothly organized that a crane crew, in one typical instance, set 100 ft. of lagging, removed the boulder and withdrew the lagging in 40 min.

After the job was half completed, John F. Cavanagh, superintendent for The Gow Company, Inc., devised a cage made of heavy screen wire on a steel frame in which one or two men might be lowered

REAMERS *(below)* at top of muck bucket can be adjusted to cut caisson of desired diameter. When raised from hole, bucket engages with latching ring under rotary table platform.



TO DUMP BUCKET, machine operator releases latch, permitting hinged leaves to drop and discharge load into truck.

TWO HINGED LEAVES *(below)* of bottom-gate bucket are equipped with sloped cutting knives which cut into soil and guide muck into bucket.

into the caisson without danger from falls of earth off the sides of the excavation. This cage obviated the necessity of temporarily placing lagging in the hole when boulders had to be removed by hand and speeded up the operation materially.

Placing Lagging—The caissons were so excavated that the lagging, when set in the hole, made a snug fit. Usually the lagging just squeezed down, but in some caissons it was necessary to drive it with hammers. If this latter condition occurred when lagging was being installed for the removal of a boulder, the lagging was left in the hole and the bucket worked through it. The reamer mechanism of the bucket is designed to take care of emergencies of this kind.

As each caisson approached the elevation of the top of the bell, the reamers were set to a smaller diameter to leave an earth shoulder just above the top of the bell to support the lagging. This procedure obviated the necessity of post-

LAGGING CYLINDERS *(left)* 16 ft. long are made up in advance to be placed in caisson when excavation has been carried to top of bell.

Concrete.—Transit-mix concrete was used in all the caissons. The concrete in the bells was lowered into place with a bottom-dump bucket, a man going down after every few buckets to level off the concrete already deposited. Concrete for the shafts was chuted from the transit-mix trucks to the top of the caisson and dropped into position from that level.

As already stated, the cylinders of lagging were made up on solid circular rings. These rings consisted of 3-in. standard channels rolled to a circle and butt welded at one joint to make them continuous. The lagging was attached to the rings by nails driven from the inside of the cylinder and clinched over the flanges of

TONGUE-AND-GROOVE LAGGING is assembled on solid-welded rings to form cylinder. Block and tackle attached to loop of rope roll lagging around rings.

TRUCK-MIXED CONCRETE for caisson shaft is dropped from chute at top of caisson. Bells are filled by bucket.

ing up the lagging. In a few caissons where boulders had to be removed after a caisson had been sunk close to final grade, earth shoulders were formed in this way to support the lagging, and the bucket worked through the lagging to bottom the caisson. A hammer then drove the lagging through the shoulder to the elevation of the top of the bell, where the final shoulder had been prepared for its support.

Excavating Bells—Although the bucket rotary is equipped with buckets for cutting bells at the bottom of small-diameter caissons, no equipment was available to excavate bells of the large size required on the Detroit work. There, each caisson was belled out to about twice the diameter of the shaft, with a roof slope of 60 deg. Belling out was done by hand.

ROTARY TABLE PLATFORM *(right)* is supported by structural bracket on fixed boom of full-revolving excavator.

the channel. When a caisson was concreted, the hydrostatic pressure of the green concrete was more than sufficient to force the lagging off the nails and hard against the sides of the excavation.

Advantages of Rotary—In addition to the speed of the bucket rotary, which is probably its greatest advantage, its machine cutting leaves a smooth side wall and, by avoiding over-cutting, reduces loss of ground to a minimum. By properly leveling the machine at the surface, it was possible to keep within the close tolerance on center (1:100) required by the specifications on the Detroit work.

Supervision—The Walbridge-Aldinger Co., of Detroit, was the general contractor for the substructure of the Detroit Post Office. Roy Pickett was superintendent in charge of operations for the general contractor. The Gow Company, Inc., of New York City, was subcontractor for the excavation and lining of the caissons and for the disposal of the spoil. John F. Cavanagh, superintendent, directed operations for the subcontractor.

PAPER BAGS PROTECT CEMENT

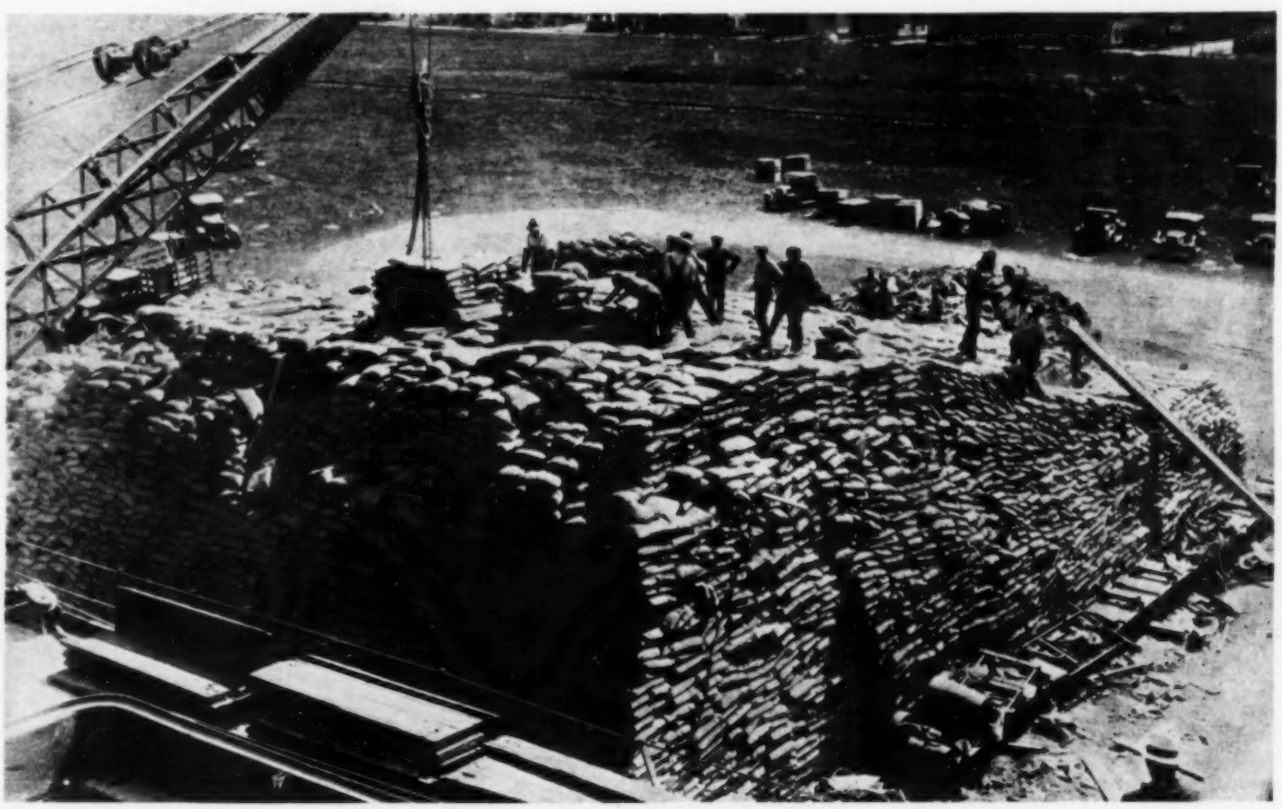
LARGE SHIPMENT of cement in sewn multi-wall paper bags is unloaded from lake cargo ship and piled in open to be used as required for concrete paving job.

Against Shipping and Moisture Losses

SEVERE shipping, handling and storage conditions involved in the transportation of 95,000 bags of cement from the Painesville, Ohio, plant of the Standard Portland Cement Co. to a concrete paving job in New York State served to demonstrate the strength and moisture-proof qualities of multi-wall sewn paper bags, which were used for the entire commitment. Railroad freight cars, cargo ships and trucks transported the cement on various portions of the route chosen, which required open mass storage of the material at one point.

Two shipments of cement were made, the first amounting to 40,000 bags and the second to 55,040 bags. After being loaded into freight cars at Painesville, the cement proceeded to Fairport, Ohio, where each lot was transshipped to a lake cargo vessel. The boat conveyed the cement to Ogdensburg, N. Y., where the cargo was unloaded and piled. Although the sacks were stacked from 30 to 80 bags high, no broken bags were found even in the bottom tiers. The bags were stored an average of 3 weeks without loss from air set. Soon after the first shipment was unloaded, rain fell steadily for 36 hr., totaling 3.48 in. of rainfall, without damage to the cement.

From Ogdensburg, trucks hauled the cement, as required, to the road project 11 mi. away. The Callahan Construction Co. was the contractor for the project, which was 8.76 mi. in length.



PAPER BAGS stand hardships of transshipment at two points and storing in high piles without breakage. Skiploads of cement are handled out of ship's hold by crane.

Helps to Successful Contracting

Second of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

II–What Contractors Should Know About the Job Before Bidding

By HARRY O. LOCHER
Contractor, New York

SOME contract-letting bodies publish, along with the specifications, an estimate of the cost of the various contract items. It seems incredible that any contractor would submit a bid, risk his valuable time and hard earned money in preparing an estimate on a piece of work that neither he, nor any member of his organization, had carefully gone over, or even seen. Yet it has been done time and again. This is not bidding—it is just reckless guessing.

Two contractors, well acquainted with a certain state engineer, were good-naturedly reprimanding him for the low estimate his department was putting on highway contracts. He came back at them about as follows: "You contractors are mainly responsible for our estimates. When we started estimating the cost of highway work we had the figures right, and they included a reasonable profit for the contractor. But, at every letting, you fellows kept cutting a little more and a little more off of our estimates, and, in justification to ourselves, we had to keep lowering the estimates or the taxpayers would think we didn't know our business. Blame yourself, not us, for the low estimates." These are the figures on which some contractors stake their all.

Examine the Site—The site of the contract should be examined thoroughly. Often, in carefully going over the ground, evidence is obtained which is of invaluable aid in arriving at correct conclusions. In a certain New England city a large trunk sewer was to be built. Contractors from several states took out plans and went over the work. Most of them concluded that, on account of the sewer's location and the lay of the ground, it was going to be a very wet proposition, requiring extensive sheeting and pumping. One contractor, however, was not at all convinced of this. For two weeks, with the greatest care and thoroughness, and without the knowledge of his competitors (much of his work being done at night) he made all sorts of observations along the line of work. He examined carefully every excavation of every sort, and he didn't confine his inspections to the excavations immediately adjacent to the proposed sewer. He went back several blocks in each direction. He collected soil and had it tested for its water-holding properties. When he found water in certain excavations and localities he made sure whether it was seepage or surface water.

"It is well to be constantly on guard against getting into a situation where you are held responsible for 'design,' unless, of course, design is part of the service your contract provides."

After gathering and studying all this information he came to the conclusion that, although directly contrary to what appeared to be true from a superficial examination, there was little to fear from water interference. He prepared his bid in accordance with his findings and was low on the contract by a considerable margin. Dire results were predicted for him from all sides. However, no water troubled him and he carried the work through to prompt completion and earned an unusual profit as his reward for insight and unusual thoroughness in sizing up the job at the start. The city, too, profited by his thoroughness. The superficial methods of some contractors in going over work, preparatory to making bid prices, is beyond belief and, in the main, is largely responsible for many of the losses later sustained.

Usually, when work is to be let, there is construction of some sort, often similar, under way in or near the locality of the new project. Almost always valuable information can be had by visiting these jobs or jobs of a similar nature, wherever they may be located. Strange as it may seem, there are many contractors who do not take advantage of this valuable aid. One old-time contractor on the West Coast used to say, "Every construction man has some fine ideas for saving money and time, and I don't know of any better way of spending some of my time than in visiting their jobs, studying the methods and the equipment they are using, and then coming back and seeing how I can apply them, either on work I am doing or on which I intend to bid."

Plans and Specifications—Plans and specifications should be studied with minute care. The success or failure of many a contract has hinged almost directly on a single paragraph, or even a sentence, in the specifications or contract. I recall one sentence in a specification which read about as follows: "The behavior of the material in the structure, rather than its theoretical grain size, will be the criterion on which results will be based." The contractor noted and gave thought to this sentence, and placed dependence on it when bidding, as tests had convinced him that the grain sizes of certain fill material would build a satisfactory structure. A law suit involving nearly $2,000,000 is now pending in connection with this project, and if taken into court would, no doubt, be settled in the contractor's favor on the interpretation of the sentence quoted above. However, litigation over such questions usually runs into years and costs a great deal of money. In the end, the net gain is usually most disappointing. It would seem prudent, if litigation seems probable, or even can be scented, to forestall it, if possible, or to avoid bidding on the contract altogether.

Specifications are often not read and studied with the care their importance deserves. More than one contractor could have saved himself a great deal of money and trouble and, in a number of cases, avoided complete oblivion, had he made a careful study of the specifications. Specifications are taken too much for granted. They are too

often assumed to be "general" or "standard." Too little importance is attached to their direct application to the work in hand.

Plans, too, come in the same category as do specifications. Too many times are they skimmed over, often by men not competent to interpret them intelligently. Careful study of the plans and specifications in advance of the letting—and even sometimes after the work is awarded—results in changes of great benefit to the contractor and with no loss of any kind to the owner. Also, in a careful study of plans and specifications possible future controversial situations may be uncovered and satisfactorily adjusted. If allowed to go unnoticed or unprotested, they are likely to get the contractor into all sorts of trouble and involve him in heavy losses.

For example, where a long, heavy fill was being placed over marsh land, the specifications made no mention of any compensation to the contractor for subsidence of the fill, requiring extra material. The contractor's tacit agreement to this condition was, in effect, "a guarantying of design" of the structure, with a consequent acceptance of the responsibility for it. There was a vast settlement in the fill, which required the placing of a very large amount of extra material. The contractor tried to collect. The case was taken into court, where the judge, unfamiliar with construction problems, rendered a decision which was grossly unjust. The principals and the contractor finally settled for a sum which was but a small portion of the large amount of extra money the contractor had been forced to put into the work.

Design Responsibility—It is well to be constantly on guard against getting into a situation where you are held responsible for "design" unless, of course, design is a part of the service your contract provides. This situation frequently arises in foundation work, often in the cases of fills, above mentioned, in the driving of piles in some untested site, or in the sinking of caissons for abutments and piers. Many contractors have got into all sorts of a mess because of failure to have such conditions thoroughly understood and agreed upon before the contract is let.

On a certain hydraulic fill dam in a remote region in the Rocky Mountains the specifications said, in regard to the material available, that "the contractor acts on the results of his own investigation and conclusions as to the suitability of the material for the satisfactory construction of the dam." The acceptance of this clause proved disastrous to the contractor. Not being qualified to judge what constituted suitable material, in the proper proportions, for the building of such a structure, he went ahead on the natural assumption that no such structure would have been located at that particular site had it not first been proved that the material available was satisfactory for the purpose. When the work began, however, it soon developed that certain core material was not available in the regular borrow pits, and could only be procured by stripping a vast area, much of it far distant from the dam site, requiring long, expensive pipe lines to get water to it, and to transport the material back to the dam. This extra work completely absorbed what profit the job would have earned. It was learned, subsequently, that had it been insisted upon, the principals, due to the remote region of the work, the scarcity of bidders, and their desire for the structure, would have assumed full responsibility for the suitability of the material and all extra costs in connection with procuring it. No contractor should make himself responsible for design, or suitability of natural material near the site, or for any other condition entirely beyond his control, unless it is known, and on record, that he will be compensated in an equitable manner.

Extra Work Claims—Few contracts are completed without a few or a large number of claims for extra work, unusual conditions, and this, that and the other thing not provided for in the contract. Of course, some of these claims are quite unavoidable—no one could possibly have foreseen them—but a great many of them, by a careful study of the plans and specifications, could have been foreseen and provided for, or else the contract could have been let alone. Again, some contractors have suffered losses by not keeping proper records of extra work as it was being done. When the time came for settlement they had nothing authentic or accurate upon which to base their claims. We shall discuss this subject later, when dealing with costs.

Payment—Is the money available to pay the contractor for his work? In most cases this question does not arise. However, it does arise frequently enough, usually on a job large enough so that the contractor can ill afford to take chances. Funds not being available can get contractors into all sorts of difficulties, both before and after signing a contract. A few illustrations will show how:

A paving contract was awarded in a certain southeastern town. Bidders' information stated that funds were to come from the sale of bonds of the paving district. This was common practice in the locality and the matter was given no thought. However, after the contract had been awarded and the contractor had started moving equipment from a distant point and assembling an organization, he was informed that there was some doubt about the legality of the bond issue. He was told that he had better hold things up until the matter could be straightened out. He did. After about five months the matter was settled, the issue was declared illegal and the contract was called off. The contractor who had gone to considerable expense at the start, and had had some expense during the entire five months, was unable to get one cent of reimbursement.

In an Eastern city bids were opened on several paving contracts on one day, and on the following day bids on bonds to procure funds for the work were to be opened. This was an old, conservative town with not even a doubt of its financial stability or ability to raise funds. But, at this time, no one wanted the bonds, and no bids were received for them. The city had required substantial certified checks with the paving bids, and the contractors, for some reason, were a long time getting them back.

One of the best known contractors in the East recently suffered a tremendous loss from the non-payment of his estimates by a certain small railroad. It was practically a knockout blow for him. He had done a considerable portion of the work when payments ceased to be made. He consulted high legal authority and they advised him to continue or lose what was then due him. He completed the line with his own and borrowed funds and is still waiting for reimbursement from the company. It is possible he may never get it.

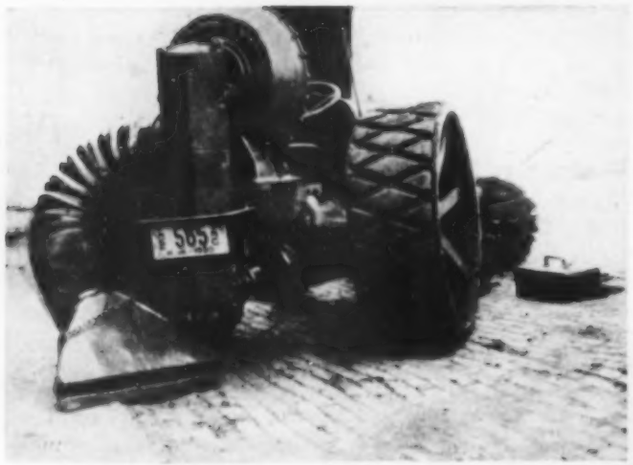
I could go on and on citing examples of losses in time and money, litigation, bankruptcy and complete oblivion for some contractors because they did not make absolutely sure that funds for paying them were available. Where there is the slightest doubt about the payment of estimates, or for extra work unanticipated and arising during the prosecution of the work, the contractor had better let the contract alone.

NEXT MONTH

In the third article in this series, to appear next month, Mr. Locher will discuss a subject of primary importance:

"Preparing Bid Prices"

Special Machines Simplify MAINTENANCE



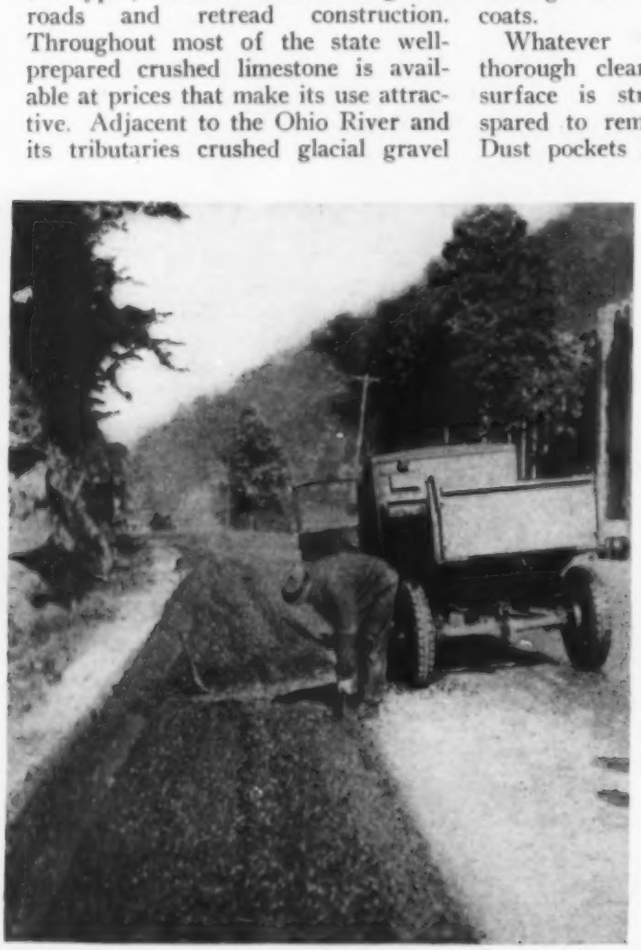
BLOWER OUTFIT mounted on tractor cleans road surface before application of prime coat. Tractor carries power broom at front end.

TRACTOR-MOUNTED BROOM AND BLOWER clean stone base preparatory to applying bituminous material.

WEST VIRGINIA has used bituminous materials extensively for surfacing all classes of roads in her state system. Methods followed in maintaining the various types of such surfacing have largely been worked out to meet local conditions. Unusually close engineering supervision of both contract and force-account work gets good results at low cost.

Much of the work done consists of two types, surface treatment of gravel roads and retread construction. Throughout most of the state well-prepared crushed limestone is available at prices that make its use attractive. Adjacent to the Ohio River and its tributaries crushed glacial gravel that has been washed and carefully sized is used. Tars, asphalt and emulsified asphalts are employed as binders, although tar is standard for prime coats.

Whatever materials are used, thorough cleaning of the old road surface is stressed. No pains are spared to remove all dead material. Dust pockets are carefully dug out.



LOADING COLD-PATCH MATERIAL which has been mixed in windrow on road shoulder by blade machine.

For two seasons the commission has used a combination rotary-broom and power-blower outfit mounted on a tractor for such work. Such good results have been obtained with these outfits that the commission is considering specifying their use in the future.

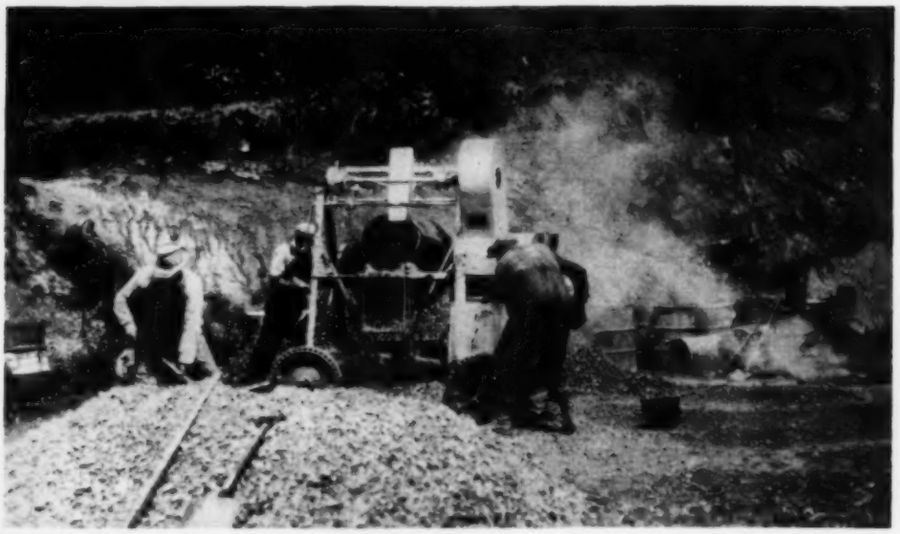
The broom is mounted on the front end of the tractor frame and is driven by power from the tractor engine. The blower is set behind the driver's seat with a drive from the power take-off of the tractor. After trying out several types and sizes of blowers, the best results have been obtained with one having the capacity of a No. 8 Buffalo, running at 2,500 r.p.m.

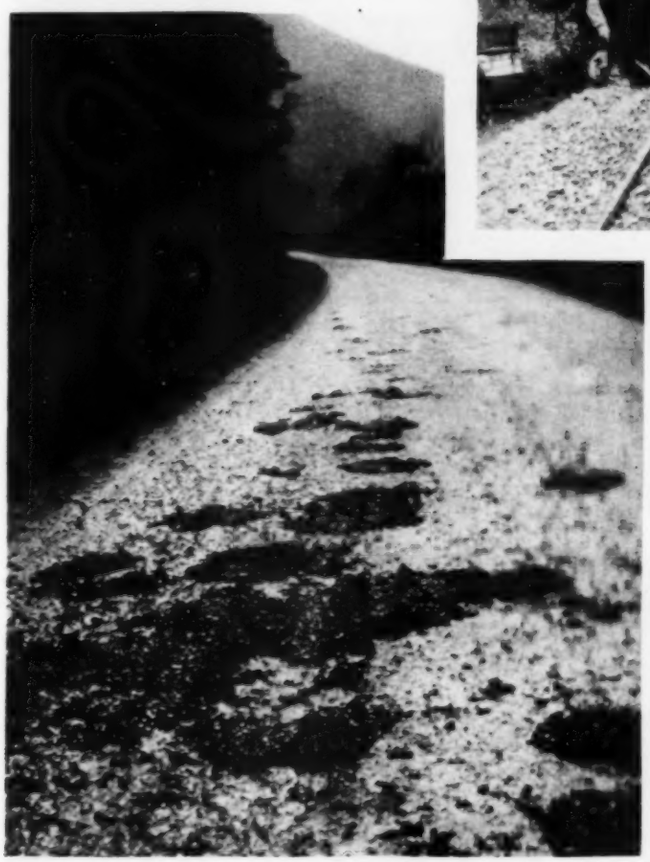
The blower discharges through a flexible connection carrying a narrow slot outlet that is swung just above the road surface. From experience to date, it appears that a slot $\frac{3}{4}$ in. wide and 72 in. long gives the best results with the size of blower mentioned.

In action the broom and blower outfit travels along the road at from 2 to 3 mi. per hour. When the surface is dry the blower drives all loose dust off the surface, leaving the material surprisingly clean. The cleaning is done about a day's run ahead of the application of the prime coat of bituminous material.

Following thorough cleaning of previously treated surfaces all broken spots and pot holes are filled with patching material of crushed stone cold mixed with asphalt. Mixing for this purpose is done at central points

Bituminous METHODS





ANOTHER METHOD of preparing cold-patch material is by mixing with portable outfit.

DEPRESSIONS *(left)* in cleaned road surface are filled by hand with cold-patch material which consolidates under traffic.

in machines or by a windrow method along one side of the road. Whenever practical the same binder is used for this purpose as will be employed in the subsequent surfacing.

Methods of windrow mixing of the patching material are essentially the same as in retread surfacing. A stretch of wide smooth shoulder 400 to 500 ft. long is first swept clean. Then the desired amount of stone is spread on this, coated with the binder sprayed on it from a truck distributor and mixed on the shoulder and the adjacent road with a blade road machine. In the final move the machine delivers the material into a windrow on the shoulder from which it is loaded into dump trucks by hand as needed.

After an old surface has been cleaned and patched for retreatment, it is primed with low viscosity tar at the rate of $\frac{1}{4}$ to $\frac{1}{3}$ gal. per square yard. When the prime coat has dried thoroughly, a second application of either tar or asphalt is made. The amount of this application also ranges from $\frac{1}{4}$ to $\frac{1}{3}$ gal., depending on how well the prime coat penetrated and how many bare spots have been uncovered by traffic.

As cover for the second binder application 15 lb. of $\frac{1}{4}$- to $\frac{3}{4}$-in. limestone, or crushed gravel of the same size that is at least 80 per cent crushed, is used. From 3 to 10 days later, depending on the weather and the condition of the surface, 0.3 to 0.4 gal. of 30 viscosity asphalt is applied with 50 lb. of $\frac{1}{4}$- to $\frac{3}{4}$-in. stone to the square yard. Usually part of the stone is put down and the asphalt spread, with the rest of the stone following.

Frequent use of a roller is made to get thorough compaction. Having begun some time ago, the commission has rapidly extended the use of a very heavy 9x16-ft. steel-shod type of drag to eliminate waves in the final surface,

FANTAIL DISTRIBUTOR spreads stone evenly from dump truck. Truck runs in reverse to keep tires off bituminous material.

HOMEMADE COMBINATION HARROW AND STEEL BROOM *(left)* **on shoulder work is pulled by truck and steered by hand. Outfit makes two rounds on 5 mi. of edges per day.**

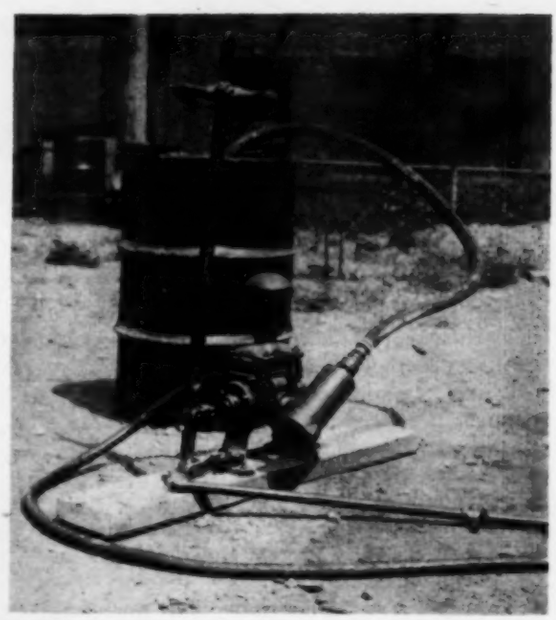
PRESSURE PUMPING OUTFIT *(below)* **on truck applies bituminous binder on patching job.**

as well as to fill local depressions. The results obtained with this drag have been so good that the commission now specifies it on all surface treatment and retread work.

Methods used on retread work are largely according to standard practice. Various special features have been developed, however, in handling bituminous surface repair work. One of these is a combination short drag harrow and steel broom outfit for mixing and leveling material placed to widen old surfacing prior to retreatment. This homemade outfit is shown in an accompanying picture. Another picture shows a fantail distributor hung under the tail gate of a dump truck to get uniform spreading of crushed stone.

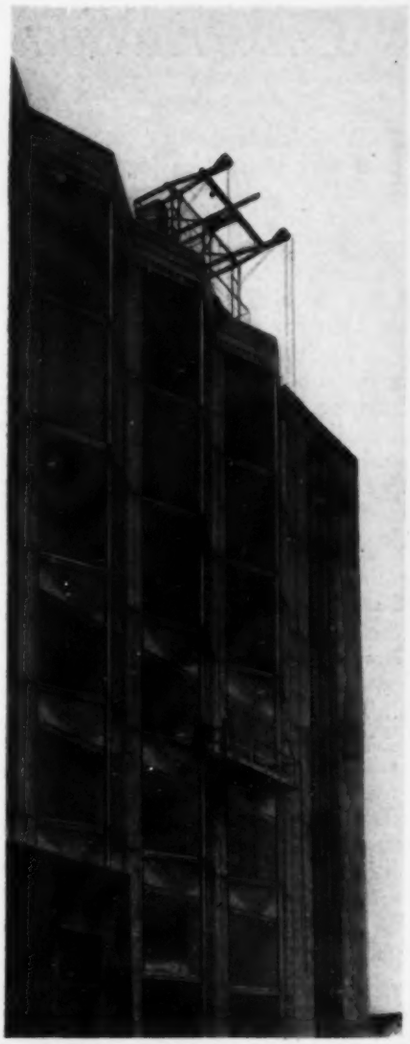
Portable pressure pumping outfits are used effectively in handling binders on both minor and extensive patches. One type of these is simply a small hand-operated pump on a skid that also carries a drum of binder. The pump suction is dropped into the drum, and the pump delivers to a hose carrying a single or double spray nozzle operated by hand. A tank truck outfit is similarly used. With these types of outfits much is done in removing depressions and waves caused by settlement. They also are handy in building up superelevation on curves.

C. P. Fortney is chairman and chief engineer and E. G. Middleton is assistant chief engineer of the West Virginia State Road Commission.

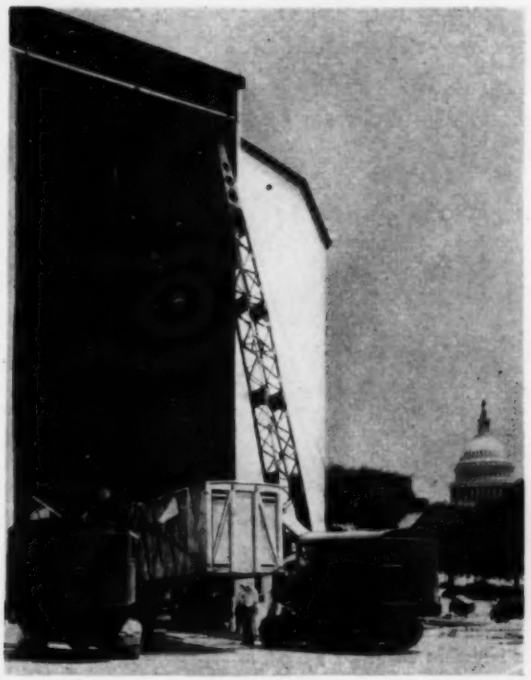


PORTABLE HAND PUMP *(right)* **is used with drum of bituminous material in applying binder on patching work.**

EXTENSIVE PATCH *(left)* **receives application of emulsified asphalt distributed by portable hand - pump outfit.**



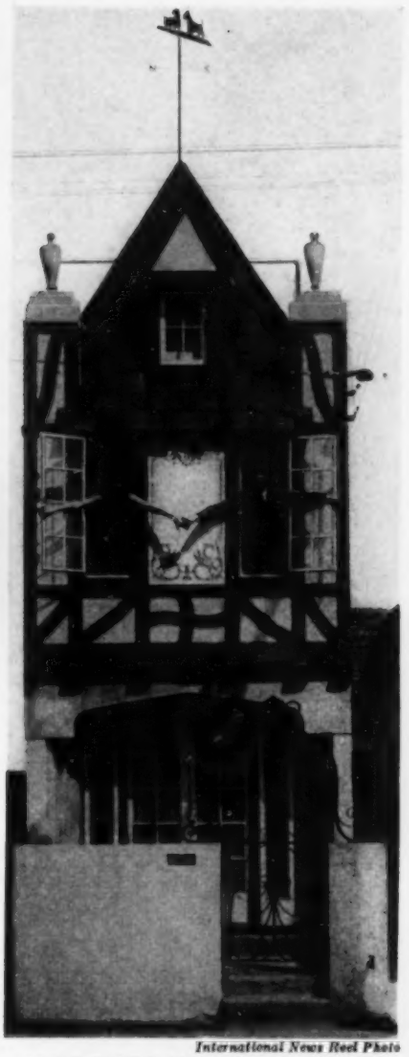
WINDOW-WASHING APPARATUS to clean large glass wall areas of A. O. Smith Corp. engineering and research building, Milwaukee, Wis., consists of hoist-operated cage suspended from hand-propelled car which travels on double rails on roof.



WORLD'S LARGEST PAINTING, "Pantheon de la Guerre," 402x45 ft. in size, arrives in Washington, D. C., from Europe wound in velour on special steel spindle and crated in neat package measuring 8½x9x54 ft. and weighing 12½ tons. Two Link-Belt crawler cranes of B. F. Diamond, Baltimore, Md., help place painting inside George Washington Bi-Centennial exhibition building.

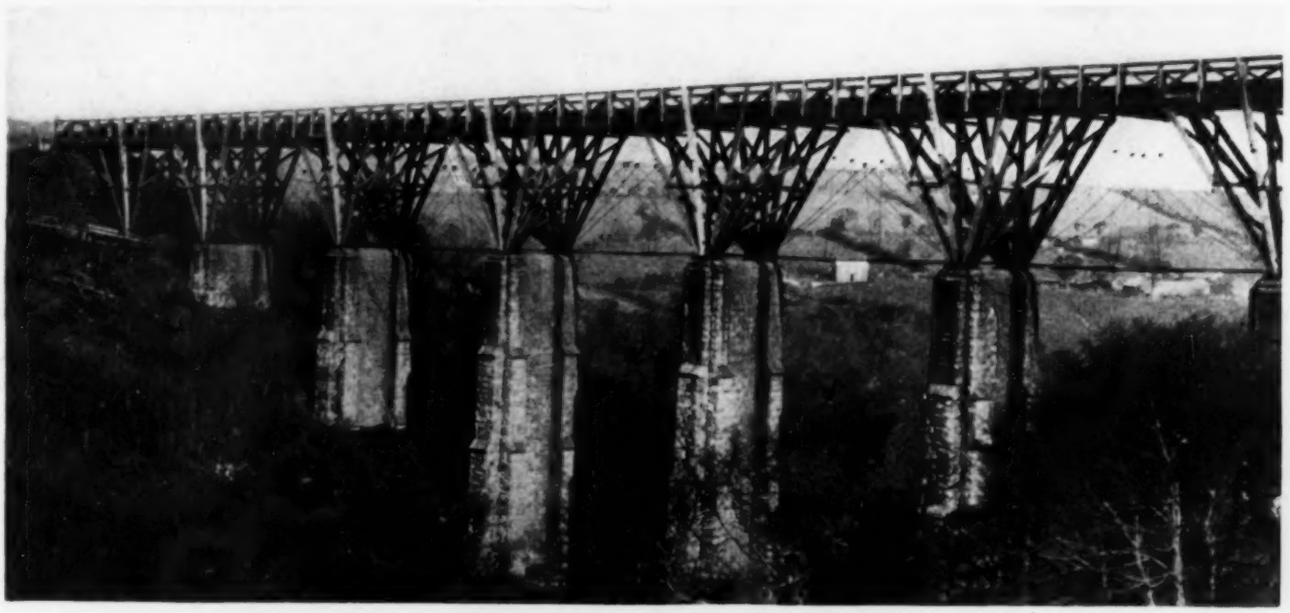
JOB ODDITIES

A Monthly Page of Unusual Features of Construction

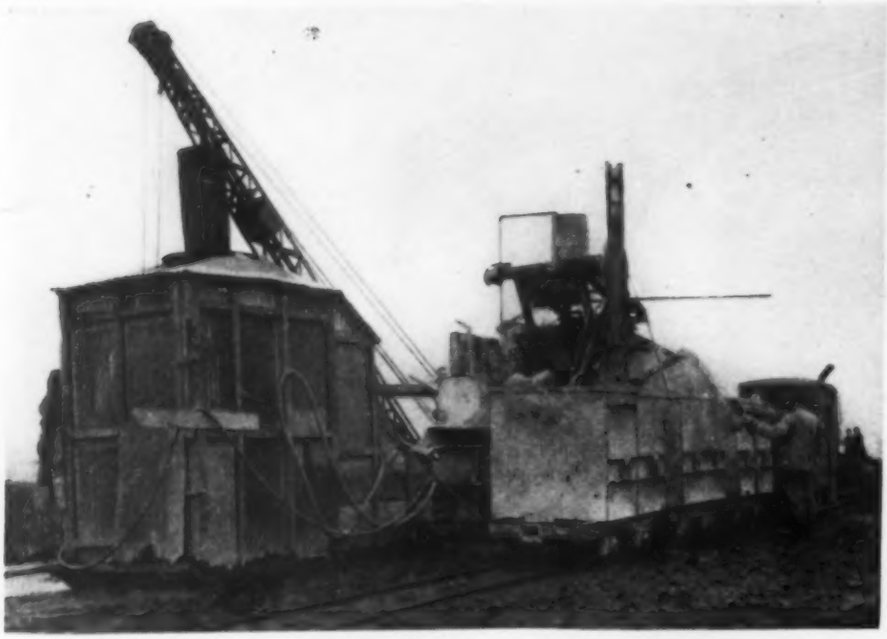


International News Reel Photo

10 FT. WIDE AND THREE STORIES HIGH. House on 10x50-ft. lot at Long Beach, Calif., is complete six-room dwelling, even to garden and space for clothes lines on roof.



TIMBER VIADUCT built about 80 years ago on Great Western Railway, England, has struts in fan shape supporting stringers of 66-ft. spans. Inclined timber A-frames carry center line of three lines of stringers. Last three of 52 timber single-track viaducts on Great Western Railway are being replaced this year.



MOVABLE BOILER mounted on skids is drawn ahead by paving mixer. Boiler heats water in tank on mixer.

Portable Boilers and Sectional Housing *aid winter seawall construction*

MOVABLE boilers to heat water at each of two paving mixers and to cure concrete inside sectional wood housing facilitated construction of a cantilever-type reinforced-concrete seawall 9,200 ft. long which the George R. Cooke Co., of Detroit, built for the board of Wayne County, Mich., road commissioners, during the winter of 1931-32. A central batching plant, heated by steam, an industrial railway hauling system, and sectional steel forms for the wall further contributed to the efficient execution of the work.

Preliminary Work—Depth of water along the line of the proposed wall varied from 6 in. to 2½ ft. In preparation for the construction of the wall, the George R. Cooke Co. entered into sub-contract with O. J. Trudeau and Joseph T. Poupore to construct a dike of clay and sand at a distance of 150 to 300 ft. from the line of the wall. The dike was located to avoid old dredge cuts and to provide sufficient area between the dike and wall for excavating fill material later. The subcontractors threw up the earth dike with a Bucyrus steam 14-B 2½-yd. dragline, which traveled over the lake bottom on its four crawler treads. During the construction of the wall, this dike successfully withstood a hydrostatic head varying from 1 to 4 ft. As the winter was practically free from east winds, the

CRANE HANDLES BUCKET *(below)* from mixer chute to forms where distance from old shore line to wall is too great for direct discharge of concrete.

BATCHING PLANT for industrial railway haulage has stock piles heated by live steam and inclosed steel bins warmed by perforated steam pipes.

Provides Winter Employment

dike suffered little from heavy seas and high water.

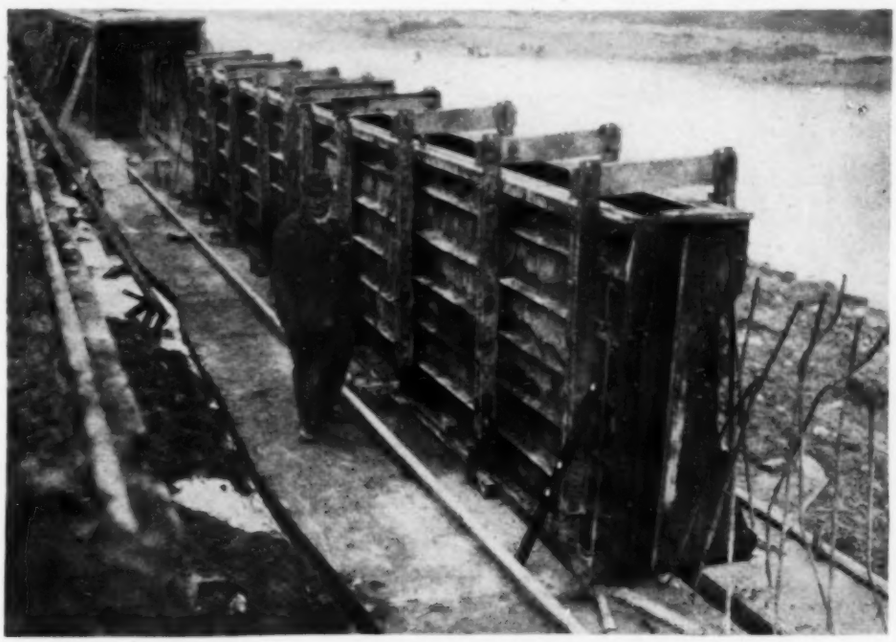
Description of Seawall—The wall protects a section of the lake shore road in the village of Grosse Pointe Farms from storms on Lake St. Clair. Distance from the road curb to the wall is 30 ft. For part of its length, the new seawall replaces an old concrete wall of doubtful permanence.

Foundation soil is mostly clay, with sand in some places. As the first operation in the construction of the footing, a line of interlocking steel sheetpiles was driven along the edge on the lake side. This line of sheetpiles is anchored to the concrete footing by hook bars bolted to the sheet piles at 5-ft. intervals. By designing the top of the footing at a uniform elevation, about 1½ ft. below lake level, for the entire length of the job, the contractor was enabled to use the same wall forms throughout. Width of the footing is 8 ft., and the depth of the footing varies from 2½ ft. to 4½ ft., the greater depth being required in soft ground. Reinforcing bars in two directions are used at both top and bottom of the footing. A keyway 3 in. deep and 6 in. wide was formed in the top along the center line of the wall.

On the footing was constructed a reinforced-concrete wall 6 ft. high with a concave face on the lake side to deflect waves. This face was set back 18 in. from the edge of the footing at the base and 2 ft. 3 in. at the top. The thickness of the wall varied from 2 ft. 3 in. at the base to 1 ft. 3 in. at the top.

Batching Plant—As the seawall was to be constructed in the winter, when gravel plants would be shut down, Wayne County purchased the sand and gravel and had most of the aggregates stored before the contract was let. The county also furnished sacked cement to the contractor as the work progressed. It was left to the contractor to collect the credits on the sacks. The George R. Cooke Co. hauled all concrete materials to a central batching plant located 6,000 ft. from the west end of the project.

An efficient steam system heated materials at this plant. A grid of perforated pipes released steam under the gravel piles as desired, and steam jets were used for heating sand. The stock piles were covered with tarpaulins to prevent loss of heat. Perforated steam pipes installed in two Blaw-Knox steel bins maintained the temperature of the sand and gravel while being held for delivery to the batchers. These bins, furthermore, were protected on four sides by curtain walls of wood and building paper. An Erie steam crane with a ¾-yd. Owen clamshell bucket transferred materials from the stock piles to the bins. Sacked cement sufficient for not more than 2 days' run was stored and protected by tarpaulins on an open timber platform from which workmen easily could dump it into the cement compartments of batch boxes on industrial railway cars.

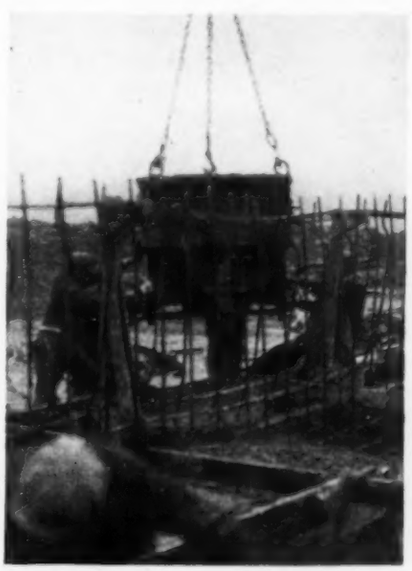


STEEL WALL FORMS are erected and filled with concrete in alternate 40-ft. sections.

TURNBUCKLE TIEROD bolted to clamp on pipe dowel in footing supports steel wall form, which is held in position at base by wood wedges driven between pipe dowel and form angle.

Industrial Railway—A 24-in. gage industrial railway transported batched materials from the plant to the two mixers. Four Plymouth gasoline dinkeys, of 4-ton and 8-ton size, hauled trains of seven Lakewood cars each, with two batch boxes to a car. Passing tracks were provided at the plant, at each of the two mixers, and at intermediate points as required. When hauling to the farther end of the job, two intermediate shunts were in use.

Mixers—Two Rex 1-yd. paving mixers, operating individually and at



BOTTOM-GATE BUCKET handled by crane places footing concrete.

SECTIONAL WOOD HOUSING consisting of side walls and roof resting on footing protects wall concrete during curing. Live steam released from pipe lines inside housing provides heat and moisture.

different times, produced the concrete for the footing and the wall. Usually, one mixer would pour footing in the morning, and the second mixer, some distance behind the first, would pour wall sections in the afternoon. Mounted on skids behind each mixer was a vertical coal-fired boiler with its fuel bin and housing. The paver pulled the boiler ahead as it advanced. Steam from the boiler was used to heat the mixing water in a 50-gal. tank on the paver. The operator adjusted the steam supply to heat this water sufficiently, within the limits of the specifications, to obtain the desired temperature of concrete discharged by the mixer. Specifications limited the temperature of the water to no more than 100 deg. F. and of the aggregate to a maximum of 110 deg. F. The concrete temperature was specified to be not less than 60 deg. nor more than 100 deg. F. As a matter of practice on this project, the George R. Cooke Co. kept the concrete temperature between 70 and 80 deg. F.

The mix was designed by the water-cement ratio for a concrete strength of 3,000 lb. per square inch. Daily test cylinders averaged 3,900 lb. per square inch at 28 days. The mixing period was 1 min.

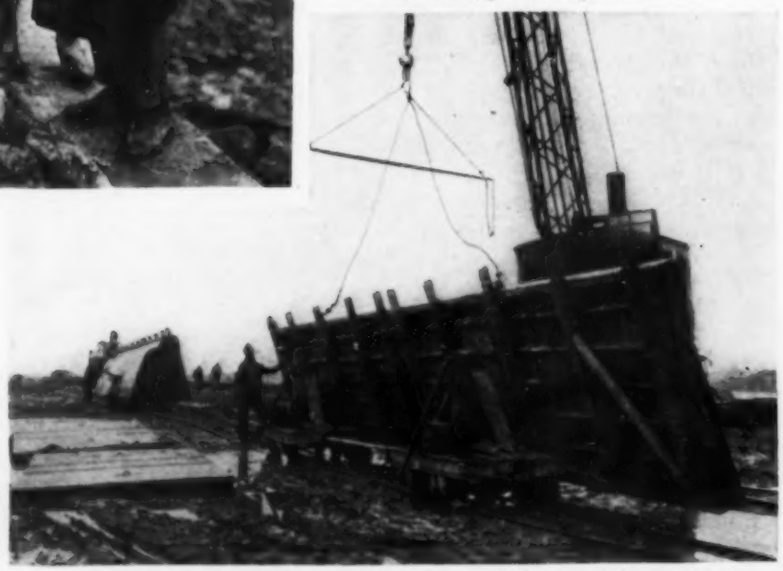
Footing Construction—A McKiernan-Terry 9B2 steam hammer, hung in swinging leads on the boom of an Erie steam crane, drove the line of interlocking steel sheetpiles along the lake side of the proposed footing. The sheetpiles, which varied in length up to a maximum of 20 ft., were driven flush with, or below, the top of the footing and extended to a depth of 5 to 15 ft. below the bottom of the footing. A ¾-yd. steam crawler shovel, supported on cross timbers, excavated the trench to the required depth. Wood forms were used where necessary for the back of the footing. In the top of the footing the contractor placed 2-in. pipe dowels about 5 ft. apart to be used in bracing the steel wall forms. Each pipe dowel was grouted up to the level of the top of the footing. Following the construction of the wall, the pipes were broken off with sledge-hammers flush with the surface. Footing concrete was poured continuously, construction joints being installed only at the end of each day's run.

A wood-pile foundation was provided in sections of soft ground, such as old dredged channels which had filled with silt. A Vulcan No. 3 steam hammer in swinging leads on an Erie steam crane drove the wood piles in two rows spaced 5 ft., c. to c., with a spacing of 4 ft. between piles in the front row and 8 ft. in the rear. The piles had a bearing capacity of about 15 tons each.

Wall Forms—Construction of the wall was carried on in alternate 40-ft. sections, with contraction joints between the sections containing crimped copper-sheet water stops. After reinforcing steel had been placed, Blaw-Knox steel forms for 160 lin. ft. of wall were erected on the footing. As shown by one of the photographs, these forms were held in position by wood wedges driven between the bottom of the form and the pipe dowels and by tierods clamped to the dowels. An Erie steam crane handled the wall forms and, also, the housing sections used to inclose the wall while the concrete was curing.

Concrete—Where the new seawall

R. D. MERRIAM *(left)*, resident engineer, and C. E. COOKE, general superintendent.



SPECIAL NARROW-GAGE CARS, connected by pipe bar, carry steel form sections for 40 ft. of wall. Crane lifts 40-ft. form sections from cars directly into place on footing.

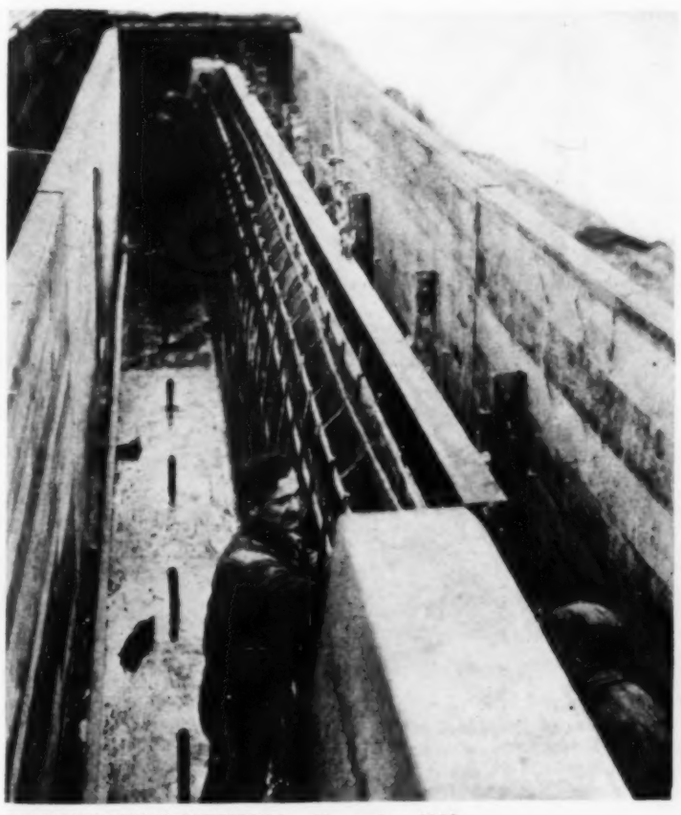
was close to the existing shore line, chutes from the mixers deposited concrete directly in the footing and wall forms. In many places, however, the distance between the shore line and new wall was too great for this method, and in these sections a Bucyrus-Erie gasoline crane placed concrete with an Owen Stange 1¼-yd. bottom-gate bucket. As already mentioned, the two mixers operated during different parts of the day. Normal progress for one day amounted to 300 to 400 lin.ft. of footing and 160 lin.ft. of wall. The job required a total quantity of 11,000 yd. of concrete.

Curing—A thick covering of straw was sufficient to protect the footing concrete during the curing process. For curing the wall, the contractor used sectional housing and live steam supplied by a movable horizontal boiler which originally had been part of an asphalt plant. As this boiler was mounted on wheels, it could be moved ahead without difficulty as the work advanced. Wood housing for the wall was in sections about 16 ft. long. The sidewalls rested on the footing and were braced by shores from the ground. Roof sections rested on the sidewalls. Live steam released from pipe lines inside the housing maintained a temperature of about 70 deg. F. and kept the concrete moist. On the day following the placing of concrete, workmen stripped the steel forms and began rubbing the surface with Mall electric finishing machines. The housing was removed when concrete cylinders tested at 2,000 lb. per square inch.

COMPLETED SECTION OF SEAWALL, with backfill finished but with cleaning up on lake side of wall still to be done.

Fill—Material for a fill of 200,000 yd. behind the wall was excavated from the area between it and the dike. This cut was limited to a maximum depth of 6 ft. below existing lake bottom and to a mimimum distance of 50 ft. from the new wall footing. The Bucyrus 2½-yd. steam dragline dug the clay and sand, which usually had to be rehandled by two 1-yd. Koehring gasoline draglines. As a final operation, the Koehring draglines cast the earth dike into the trench excavated for the dike.

Direction—In general charge of the project for the board of Wayne County road commsisioners were L. C. Smith, engineer manager; H. A. Shuptrine, bridge engineer; and F. S. Roser, construction engineer. Operations in the field were directed for the road commissioners by R. D. Merriam, resident engineer, and for the George R. Cooke Co. by C. E. Cooke, general superintendent.

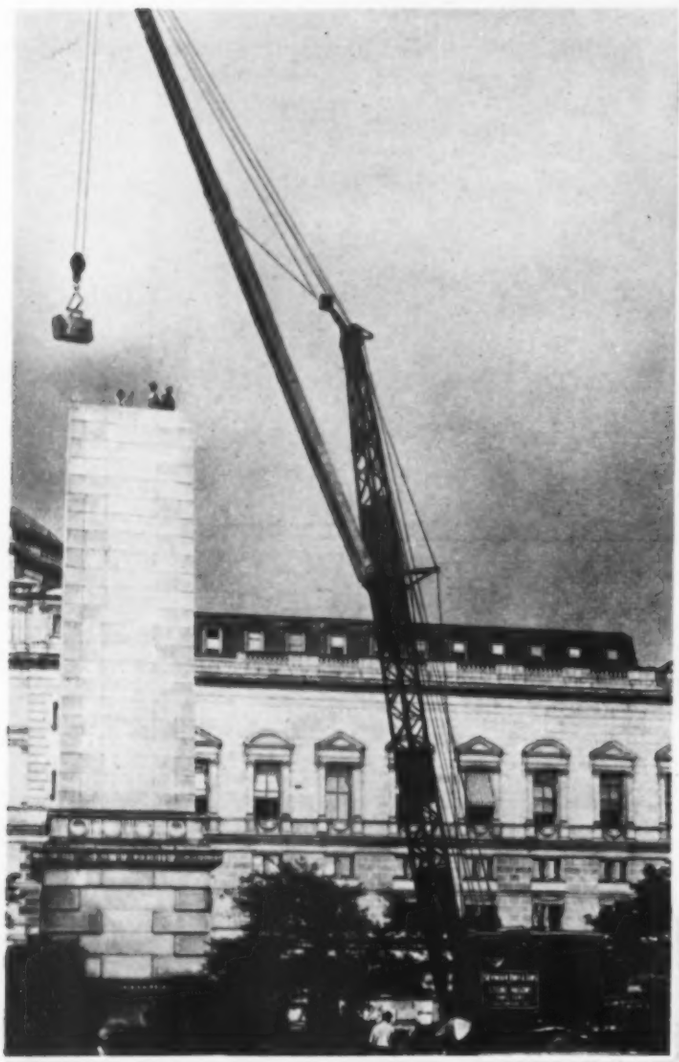


INSTALLING STEEL FORM *(left)* **for 40-ft. section of seawall.**

PORTABLE BOILER of old asphalt plant supplies steam to cure wall concrete inside housing.

Getting Down to DETAILS

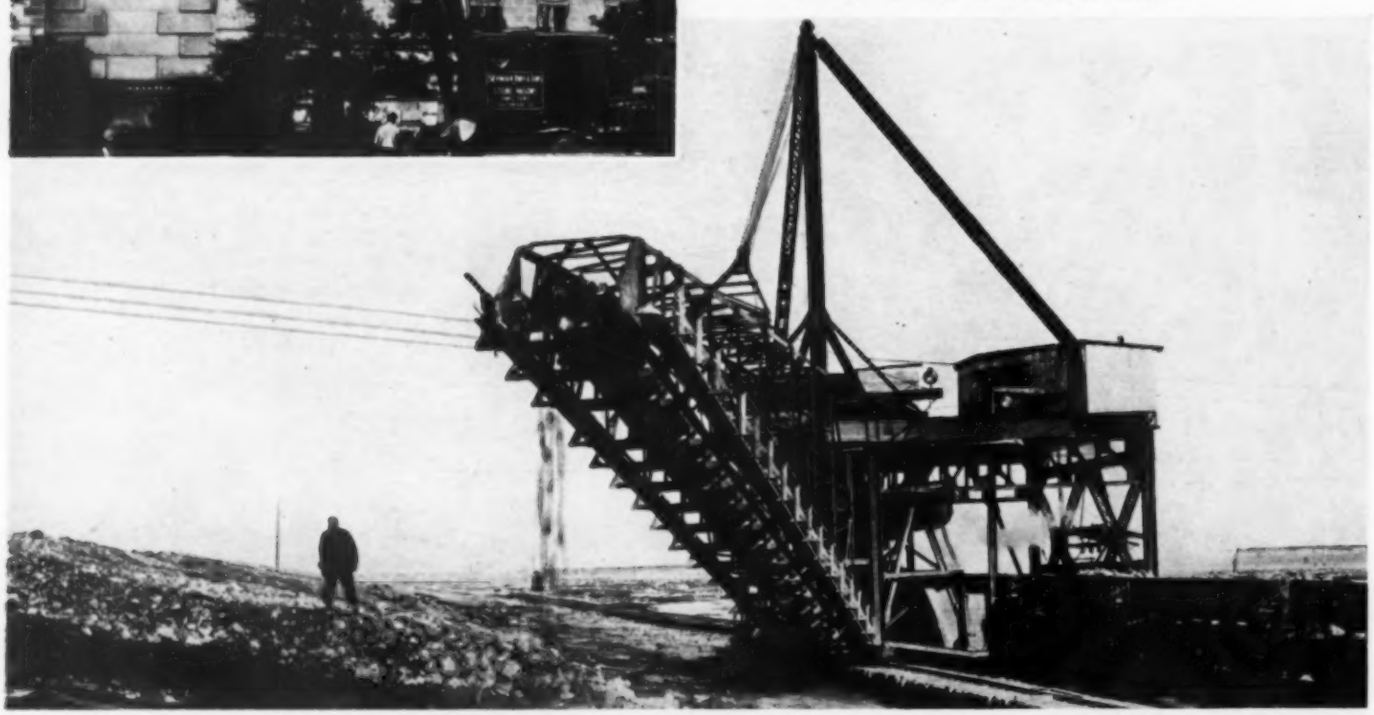
Close-up Shots of Job Methods and Equipment



Keystone photo

CONCRETE-LINED CANAL 2 mi. long under construction across bogs and moors of Perthshire, Scotland, as part of Grampian hydro-electric development.

48-FT. JIB ON 60-FT. BOOM of Link-Belt gasoline crane *(left)* sets stone at high levels for Seymour Ruff & Sons, Inc., on additions to Library of Congress.



MOBILE RIPRAP-PLACING MACHINE to deposit stone protection on 30 mi. of embankment along intake canal at Beauharnois hydro-electric project on St. Lawrence River, Quebec, consists of swinging, bridge-type boom of 106-ft. overall length, carrying 36-in. belt conveyor, mounted on counterweighted derrick gantry traveler formerly used on powerhouse construction. Air-dump cars of 20-yd. capacity discharge crushed rock up to 14-in. size directly into skip which elevates rock to hopper delivering via pan conveyor to boom belt. Machine, weighing 280 tons, handles five-car train in 20 min.

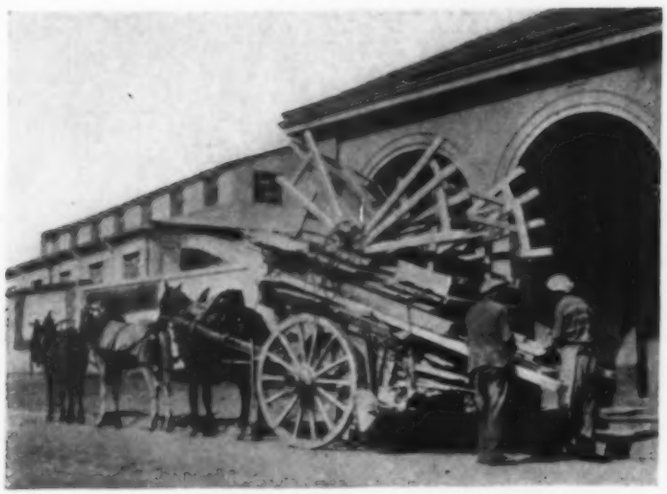
DRAG SCRAPER operated by Willamette-Ersted double-drum hoist on Caterpillar 15-hp. tractor cleans sand and gravel out of 500-ft. culvert and reduces originally estimated cost of $1,100 by more than two-thirds.

READY - MIXED CONCRETE *(right)* for deck construction of Riverside Drive viaduct, New York City, is delivered by revolving-drum agitator truck which chutes concrete over wide area from elevated platform. As work is carried on in winter, concrete is required to have temperature of at least 100 deg. F. when delivered.

Halbran Photo

STRUCTURAL-STEEL BARRICADE riveted at base to viaduct steel and extending 20 in. above present 14½-in. curb is being tested for 200 ft. along 125th St. viaduct on Riverside Drive, New York City, to determine its efficacy as preventive of increasing number of fatalities caused by motor cars climbing curb and plunging through rail to street 75 ft. below. Barrier, erected by department of plant and structures, is heavy steel-plate girder strongly kneebraced on sidewalk side. Base is inclosed in concrete to present curb level.

SURFACE GRINDER similar to that used on concrete pavements removes high spots from asphalt pavements in St. Louis. High spots formerly were corrected by cutting out and replacing the pavement.



PRIMITIVE TRANSPORTATION in Algeria. Builder loads his scaffolding materials on two-wheeled cart drawn by three horses.

HARBORFRONT DELIVERY of sand and gravel. Crew of small sailboat unloads aggregates by carrying sackfuls ashore.

American Engineer Observes Construction in FOREIGN LANDS

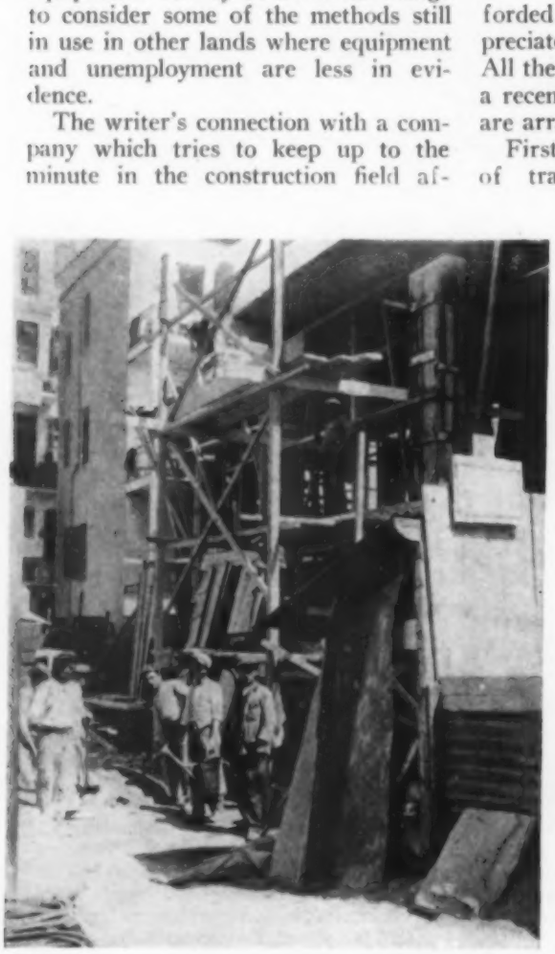
By DAN PATCH,
Industrial Engineer,
Morton C. Tuttle Co.,
Boston, Mass.

READERS of *Construction Methods* are accustomed to have spread before them the latest time- and labor-saving methods and equipment. It may be a restful change to consider some of the methods still in use in other lands where equipment and unemployment are less in evidence.

The writer's connection with a company which tries to keep up to the minute in the construction field afforded him a good background to appreciate the contrasts described herein. All the photographs were taken during a recent trip abroad, and the incidents are arranged in order as observed.

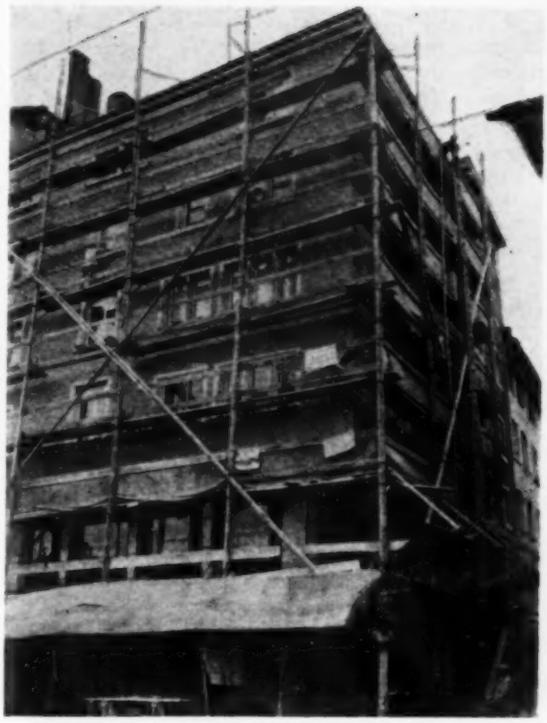
First of the contrasts was a matter of transportation. One from the United States as he travels is struck by the fact that in many lands the horse has not yet been abolished as an important transportation factor, though mechanical motive equipment is undoubtedly gaining.

As I was walking along the street in Oran, a French colonial city in Algeria, I noticed a contractor loading his horses and staging on to a two-wheeled cart drawn by three horses in tandem hitch. I can imagine the reaction of

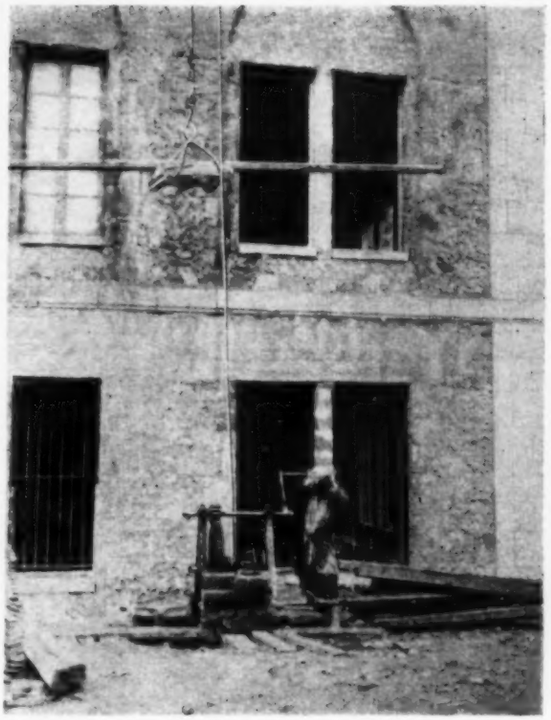


NOISELESS METHODS *(left)* of mixing and elevating concrete by hand shovels. Concrete is raised by shovelmen from platform to platform until it reaches level for placing.

MATERIALS HOIST in Damascus. Pail filled with gravel is hoisted by man in street, who pulls on rope reeved through overhead block.



POLE SCAFFOLD *(left)* **constructed of unmilled poles rises to considerable height on building at Zurich, Switzerland.**



ONE-GIRL POWER at 50c. per day runs material hoist at Beirut, Syria.

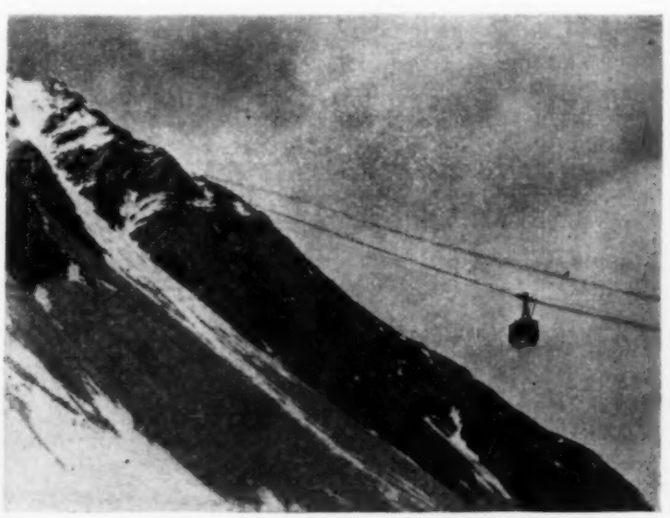
one of our superintendents if he were to be confined to this mode of moving materials, but in a part of the world where wages are not so high and where early occupancy and interest during construction are not so much stressed it is probably an economically sound method.

My attention was next attracted to construction in Saloniki where along the water front I found a fleet of small sailing vessels unloading sand for construction concrete. The operation appeared to be a case of employing poor equipment at about 100 per cent efficiency. As one of the boats came sailing in from over the bay I wondered that it kept afloat. It was loaded down almost to the gunwales, and the sides were protected from the splash by canvas weather cloths attached to the rail. The boat was cleverly maneuvered toward a vacant mooring, a stern anchor dropped overboard and the boat stopped with its prow almost against the seawall. Projecting from the bow on either side was a timber on which rested the end of a single plank thrown up to the seawall. The sail was furled, and in no time one of the crew was shoveling like mad to fill a sack with sand. When full it was swung to the back of his mate who negotiated the gang plank and dumped his sack of sand in a two-wheeled one-horse dump cart. When the cart was full it departed for some constructon job. Following this scent I came to a concrete gang in action on a building project.

Here there was none of the familiar sounds connected with pouring concrete, as there were no mechanical aids. The batch first was mixed in a dry pile on the ground. Then, while one member of the gang sprinkled the pile from a huge water pot, the others spaded it until the concrete was ready for placing, when the ground crew shoveled it to a platform a little more than head high above the ground. Here a second man shoveled it to platform No. 2 above him, and so on until it finally reached a wheelbarrow on the level at which the concrete was being placed. The operation was very nearly noiseless.

It was here in Saloniki that I had

HOW DID ANCIENTS PLACE THIS STONE? Man at left climbed tree to reach massive block measuring 13x13x63 ft. in temple wall at Baalbek, Syria.



ROPE TRAMWAY carries passengers up mountain at Innsbruck, Austria. Rope tramways are much used for material handling in central Europe.

my first lesson in "safety first" a la East. I was inspecting a building which was nearing completion, and which in the United States would probably have been completed a full year or more earlier. There was a large central stairwell around which there was absolutely no protection whatever, not so much as an empty nail keg. I expressed my surprise at what we would call carelessness for the safety of employees, and the representative of the owners informed me that there was no law compelling them to spend any money for safety, that the workmen were all trained to be cautious, that any accident was considered due to personal carelessness or to an act of God, and, anyway, that life was not worth so much there as in the U. S. A.

In old Damascus I got another lesson in construction methods. Aggregate for the job was dumped in the street. A workman shoveled an ordinary galvanized water pail full of the material and hung the pail on a hook attached to a rope leading through a block overhead. A second man in the street on the other end of the rope hauled the pail up to the story on which the batch was to be mixed, where a third man removed the full pail and put an empty one in its place.

At Baalbek was an example of construction of other days which gives us moderns a chance to do a lot of guessing. In the wall of the temple enclosure is a single stone about 63 ft. long by 13x13 ft. in section. The stone is at a considerable distance from the ground, as may be seen by the photograph. In order that the size of the stone might be judged, my nephew, R. D. Patch, of the American University at Beirut, climbed a tree from one of the limbs of which he could reach the wall. He will be noted at the left in the picture.

In Beirut I was again curious about industrial accidents when I saw that the girls who carried materials worked in their bare feet. The superintendent, who happened to be a graduate of the Massachusetts Institute of Technology, informed me that the number of nail accidents was insignificant compared to common American experience. Girls in the East do much of the common labor. On this Beirut work, girls were the power for the material handling hoists. One girl-power sufficed for many loads, but, if the load was too heavy, another girl worked an additional crank.

On road construction, earth is carried in baskets on the heads of girls rather than in wheelbarrows pushed by men. As we drove across country we passed a road construction camp with its tents for men and tents for women. The method of road dressing was as follows:

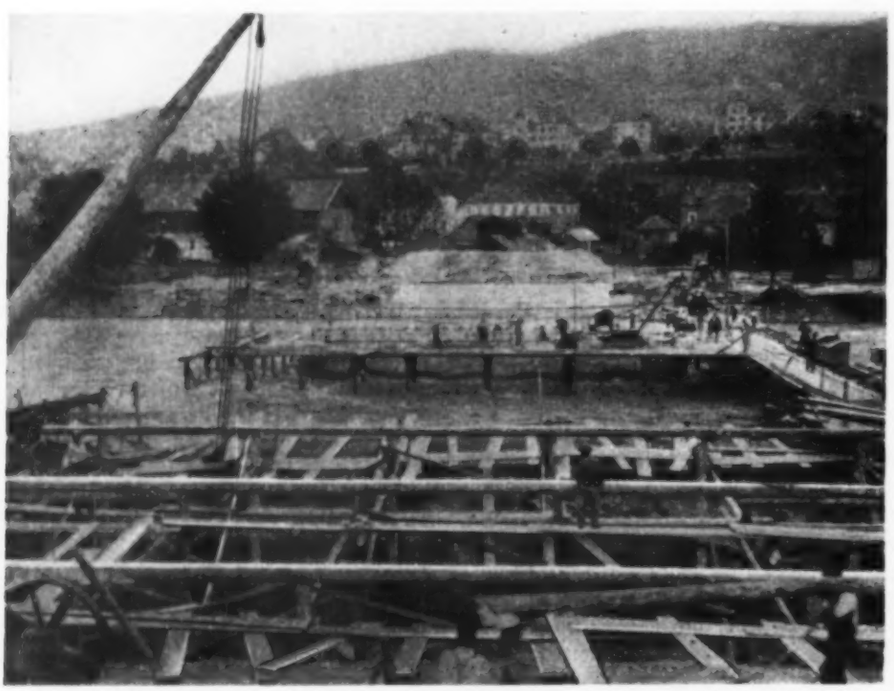
A couple of men with a bar would loosen a field stone and lift it to the head of a girl who would walk to the road and drop the stone. Here a man with a flexible handled striking hammer would break the stone to the size desired. A contractor informed me that this method was cheaper than crushing stone mechanically. I was not so fortunate as to get a snap shot of the girls carrying stone, but as I came through Nazareth I got a picture of a couple of damsels carrying jars of water from the fountain, which will give an idea of how well these girls use their heads.

In Zurich I passed a job which gave a good idea of the European method of pole staging. It seems to be the general practice to use unmilled poles for this purpose. At Innsbruck they were constructing a new bridge over the Inn, where the operations reminded me more of home.

One piece of equipment which seemed to be very popular in central Europe was the aerial cable tram. It was used not only for materials handling but often for passenger service to mountain stations as at Innsbruck where the car accommodated 19 passengers, lifting them to a station near the top of Hafelekar.

Although many of the construction methods of other lands might conceivably be of great help to the unemployed, it hardly seems probable that they will ever be adopted by our own contractors.

I asked one contractor in the East where he got his cement and aggregate tested. He replied that he didn't. He said that the only testing machine he knew of in the country was broken, and explained that the materials for the construction of the floors above were carried on the newly poured floors, so that if anything was wrong it would show up while the construction progressed.



CONSTRUCTION FALSEWORK for bridge across Inn, at Innsbruck, resembles similar structures in United States.

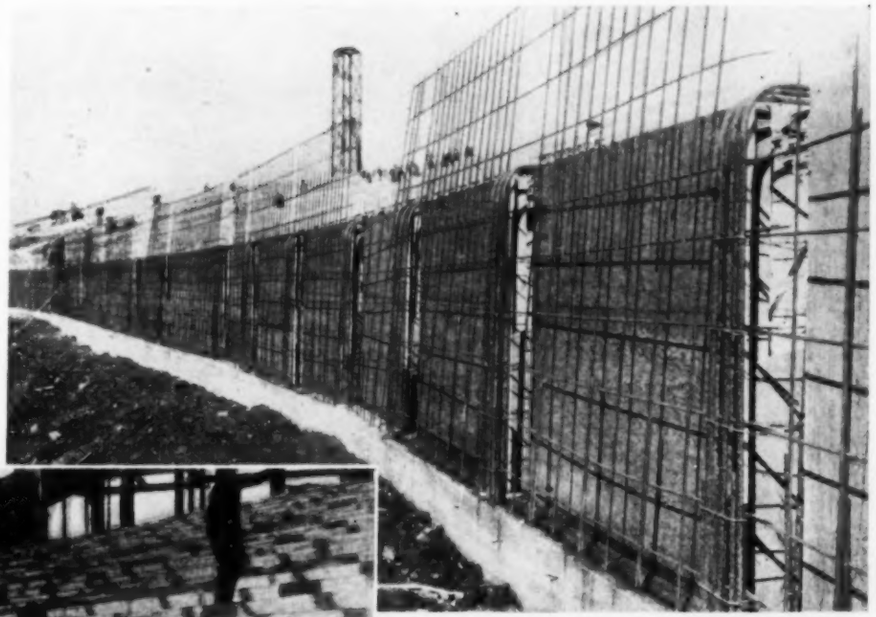
GRACEFUL NAZARENES transport water jugs, as well as construction materials, on their heads.

PLYWOOD LINING
Cuts Form Costs

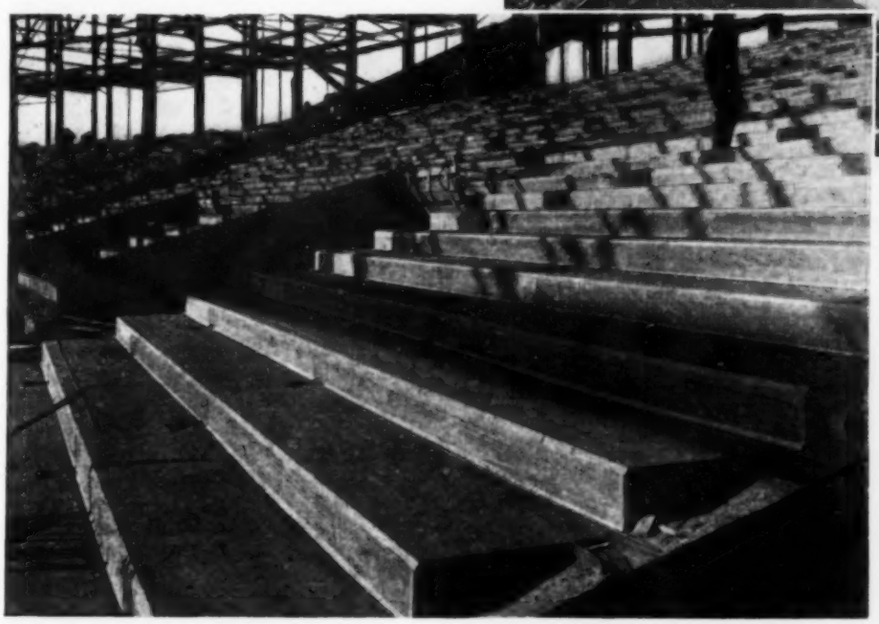
TO CONSTRUCT 1,000,000 sq.ft. of forms needed in building the municipal stadium at Cleveland, Ohio, the W. J. Schirmer Co., of the same city, general contractor, elected to use three-ply fir plywood ¼ in. thick because of the economies effected by the adoption of this material. The economies included savings in the labor of erecting and stripping forms, in the finishing of exposed concrete surfaces, and in heating of green concrete during cold weather.

Because of the light weight and various fitted dimensions of the plywood panels, workmen could handle them rapidly in erection and stripping, lowering the labor cost for these operations. On horizontal surfaces flooring strips had to be laid across the joists under the plywood lining to help carry the load, but, in spite of this extra support, use of the plywood meant some saving. As panels could be ordered in widths to fit beam and column forms, much sawing on the job was eliminated.

Broad, smooth surfaces of the plywood panels, which were available in sheets up to 8½x16 ft. in size, and close fitting of joints made possible by the uniformity of the edges practically eliminated hand finishing of exposed concrete surfaces. By applying paraffin oil to the plywood at about every third use, the contractor prevented adhesion of concrete and used the same lining as many as five times. About 250,000 sq.ft. of plywood served for 1,000,000 sq.ft. of forms. In cold weather, the ¼-in. thickness of the plywood permitted heat from salamanders to reach the concrete much more readily than thicker lumber.



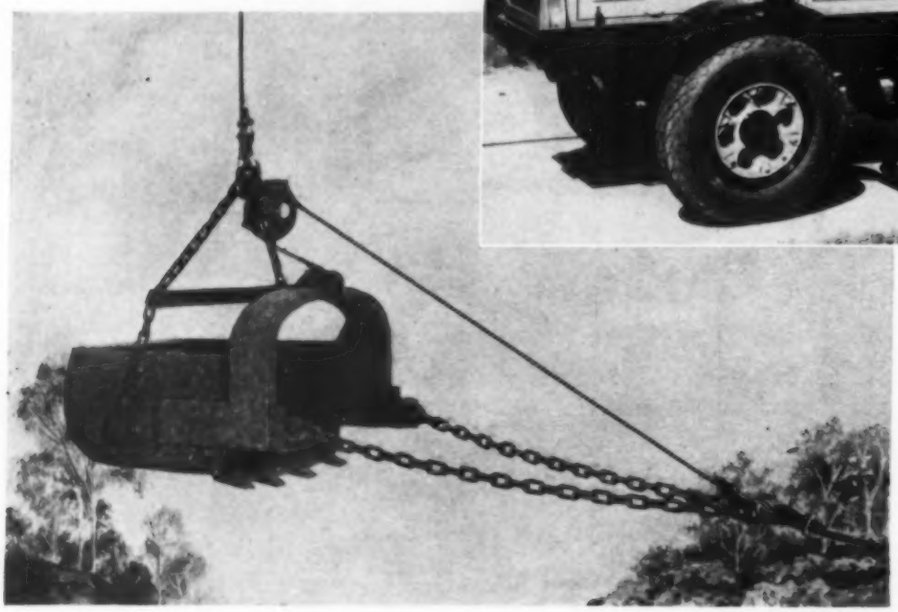
UNBROKEN SURFACES and flexibility of large plywood panels increase their usefulness for curved wall forms.



BLEACHER DECK FORMS *(left)* are erected on studding supported from structural steel by heavy wire hangers. Plywood lining assures unblemished surface on under side of concrete.

LARGE SHEETS *(right)* of plywood and tight joints practically eliminate marks on under side of concrete floors and ramps. Note flooring strips on joists to back up plywood.

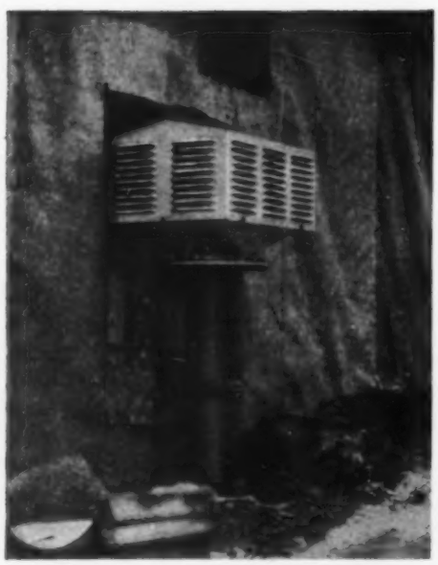
HEAVY-DUTY TRUCKS *(right)*, ranging in size from 2- to 2½-ton four-wheel drive to 15-ton six-wheel drive for road building and maintenance and snow removal. Equipped with aero-dynamic type cab fitted with rear view mirror, windshield wiper and other pleasure car appointments. Has 6-cylinder, 91-hp. motor with 411-cu.in. piston displacement. Five speeds forward and one reverse.—Four Wheel Drive Auto Co., Clintonville, Wis.



DRAGLINE BUCKET *(left)* designed for digging in light soils on which plow is used, and constructed by a combination of electric arc welding and hot riveting to assure maximum strength and a smooth, clean surface that will shed earth easily. Hitch plate construction enables contractor to obtain any desired pitch of bucket. Available in 1-, 1½-, 1½-, 1¾- and 2-cu.yd. capacities.—Page Engineering Co., Chicago, Ill.

NEW EQUIPMENT *on the Job*

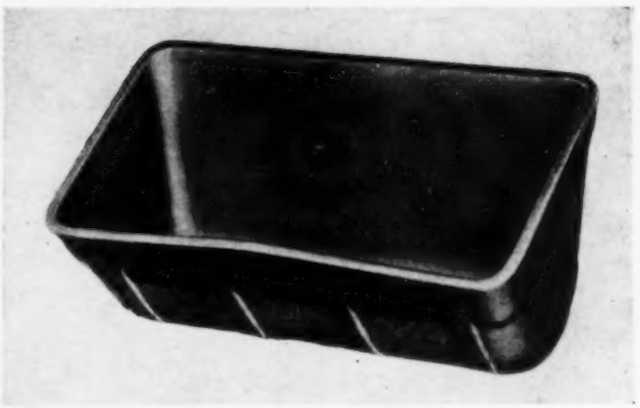
ELECTRO-MAGNET VIBRATOR for vibrating concrete during construction work, consists of a horseshoe magnet and an armature, the space between the two being held open by springs. By using patented Syntron principle of a pulsating current, this space is closed 3,600 times per minute on 60-cycle alternating current, thus setting up a vibration. Vibrator can be fitted with handle or vibrating spud for vibrating floor forms, flat slab placements or reinforcing bars in concrete products. Other attachments: vise clamp for attaching vibrator to stud or wale of building forms; chain clamp for clamping vibrator to round sewer pipe mold.—Syntron Co., Pittsburgh, Pa.

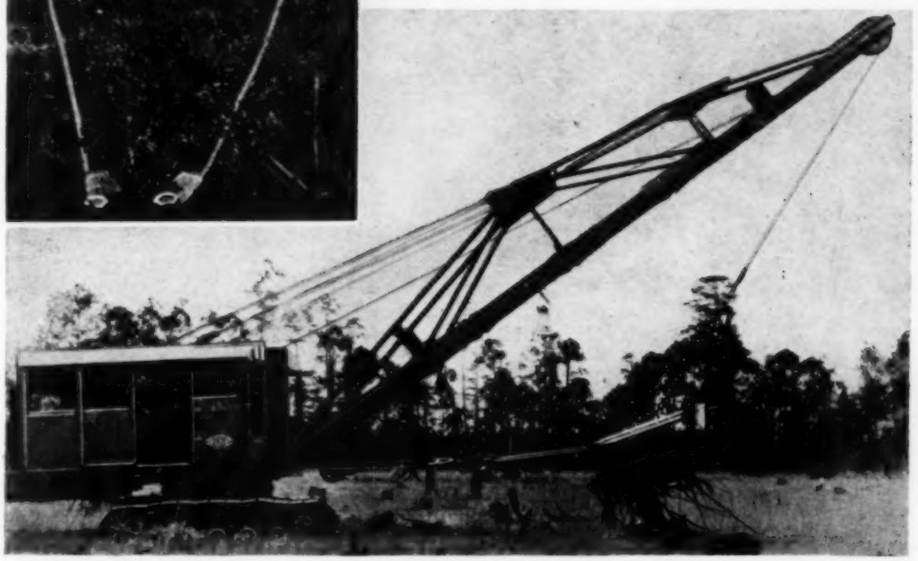


DRY FELT TYPE FILTER UNIT of 880-cu.ft. capacity was encased in weatherproof housing and installed on each compressor air intake pipe at the new water tunnel being constructed as part of the Metropolitan Water Supply System for greater Boston, Mass. This installation has been in operation for more than five months, during which time more than 150,000,000 cu.ft. of air has been drawn through filters, thus safeguarding battery of Sullivan compressors from fine dust gravel handled at shafts.—Coppus Engineering Corp., Worcester, Mass.

FLOOR SANDER *(below)*, an 8-in. machine equipped with a 1½-hp. motor with frame redesigned to make possible close sanding, thus eliminating nearly all hand scraping at the edges except at butt ends of floor. Cast aluminum guard covers fan, drive pulleys and belts, safeguarding operator, furniture and woodwork.—Porter-Cable-Hutchinson Corp., Syracuse, N. Y.

ELEVATOR BUCKET *(right)* for heavy-duty work in 8x5-, 10x6-, 12x7-, 14x7-, 16x8- and 18x8-in. sizes, has following features: heavy back; heavy lip; reinforced corners; front reinforcing ribs; reinforcing bead around ends; middle of lip raised to reduce digging strains; made of Promal, new, strong, long-wearing metal. Ribs down front and bead around ends supply added resistance to strain on bucket under severe service. —Link-Belt Co., 910 S. Michigan Ave., Chiçago, Ill.





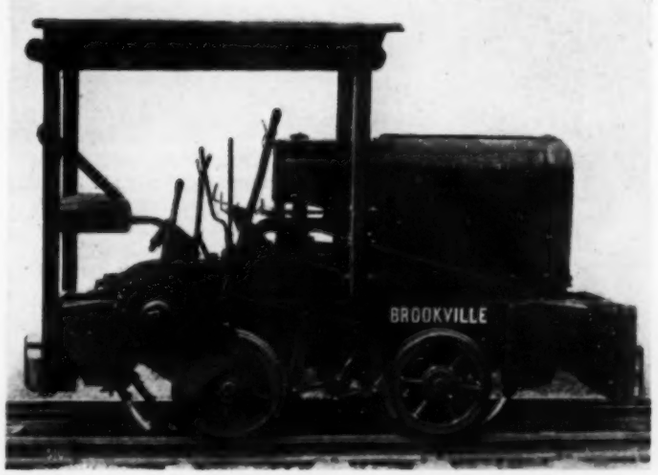
If You Want Further Information—

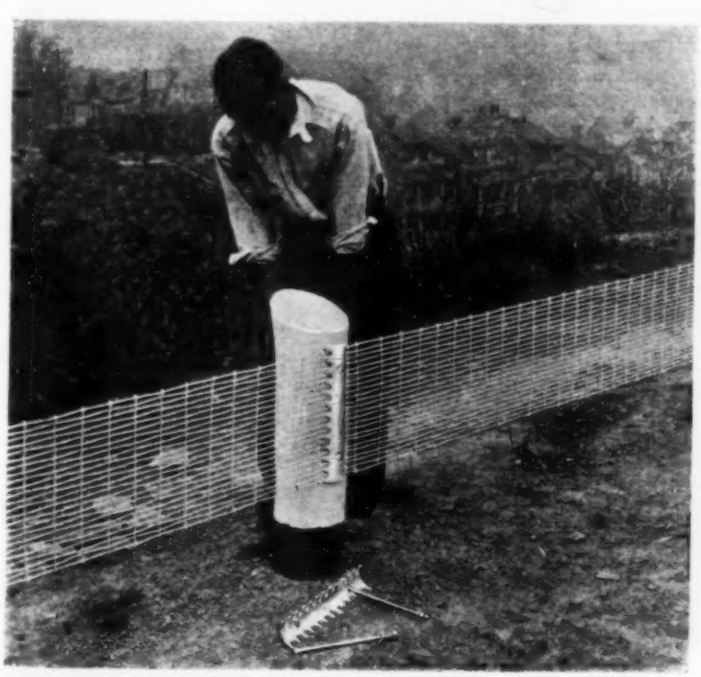
Within the space limits of these pages it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

INDUSTRIAL LOCOMOTIVE *(below)*, 4, 5, 6, 7 and 8 tons in weight, powered by McCormick-Deering tractor. Speed range, three forward and three reverse from 2 to 15 mi. per hour at 1,150 r.p.m. Features: heavy unbreakable steel frame, sanders, dual brakes and dual spring journal boxes. Steel-tired drive wheels, standard equipment. Cab and curtains optional. Overall clearance: width, 59 in.; height, less cab, 5 ft.; with cab, 7 ft. Drawbar pull: 4-ton, 2,000 lb.; 5-ton, 2,500 lb.; 6-ton, 3,000 lb.; 7-ton, 3,500 lb.; 8-ton, 4,000 lb.—Brookville Locomotive Co., Brookville, Pa.

STUMP PULLER *(above)* for clearing land of heaviest, deep-rooted stumps. Reeved up and operated like dragline bucket. Drag cable is attached to triangularly reeved cable *(insert)* at front end of puller. Hoist line is fastened to spreader bar. When drag cable is released, puller arms open automatically and are lowered around stump at ground. In pulling, drag cable draws arms together embedding their knife-like edges in stump. Continued pull on drag cable with hoist cable held taut loosens stump which is raised to proper height, swung to one side and dropped. Maximum pull, 25,000 lb.—Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.





SAFETY HIGHWAY GUARD *(left)*, designed to prevent damage to automobiles and trucks and injury to occupants. Consists of 14-in. band woven under tension from alloy steel wire of high tensile strength with an elastic limit equal approximately to 95 per cent of its ultimate strength. Develops under test total breaking strength of more than 50 tons. Band is zinc-coated and can be painted as desired. Can be placed in position on posts so that bumper or wheels of car leaving highway can be deflected back on to road without hitting posts. Manufactured in standard rolls of 500 lin.ft. Either steel or wood guard posts are placed 14 ft. c. to c. for use with guard band which is attached to posts with clamps designed to allow free movement of band and distribution of shock from impact.—Pittsburgh Steel Co., Pittsburgh, Pa.

Present and Accounted For —

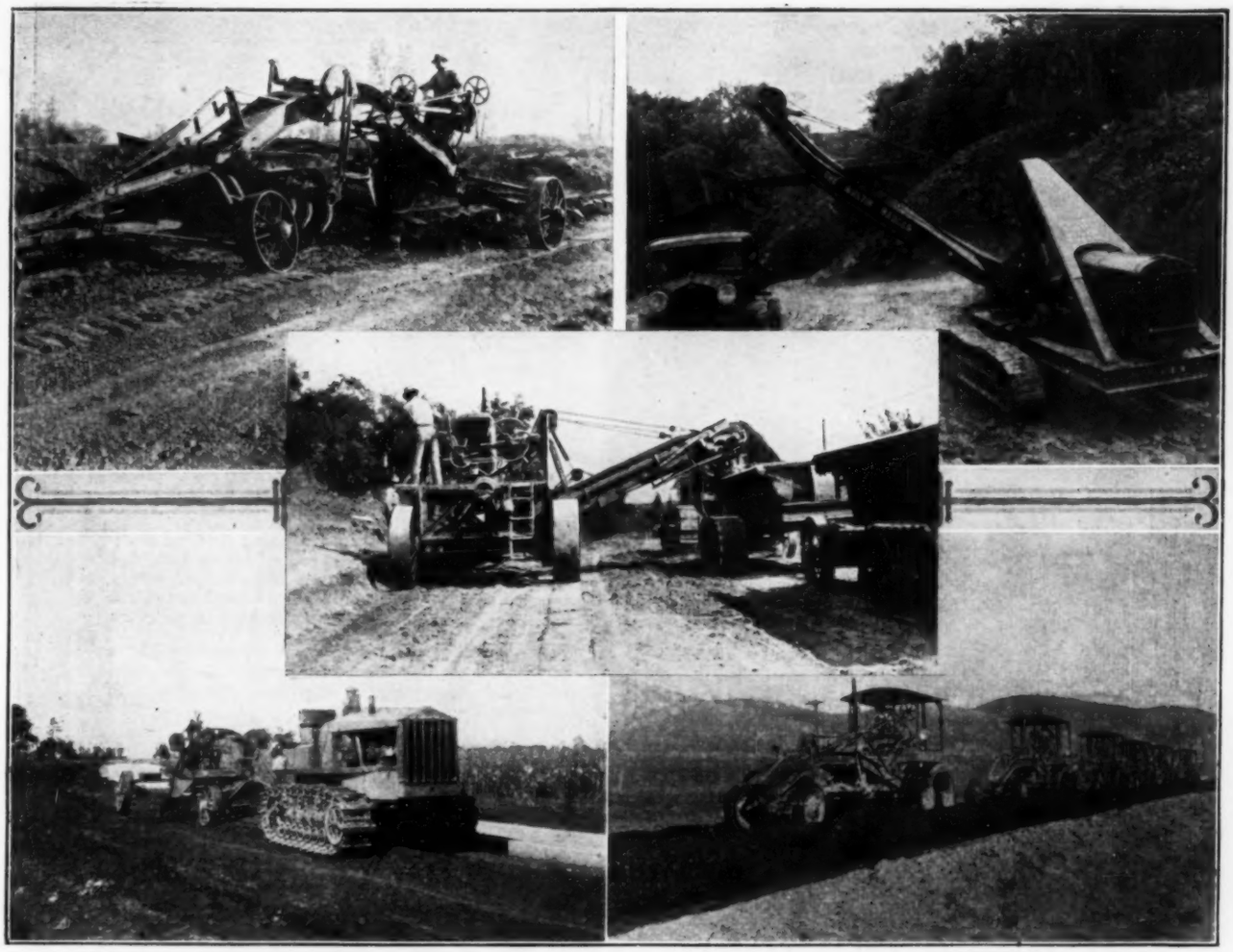
A Page of Personalities

ROBERT ISHAM RANDOLPH, vice-president of Randolph-Perkins Co., consulting engineers, Chicago, is serving as director of operations for that city's Century of Progress International Exposition which will open next year. Mr. Randolph recently completed two years of service as president of the Chicago Association of Commerce.

F. E. LAMPHERE, formerly construction manager, United Engineers & Constructors, of Philadelphia, has been appointed engineering executive to the engineering advisory board of the Reconstruction Finance Corporation, Washington, D. C. He will direct the staff of engineering examiners appointed by the board to assist it in passing upon applications for loans.

VIC H. HOUSHOLDER *(left)*, district manager for the California Corrugated Culvert Co., at Phoenix, Ariz., is the newly elected president of the American Association of Engineers. After graduation from the University of Kansas in 1915, his engineering service included geological work with the Independent Oil Co., in Oklahoma, construction of the Gillespie and Cave Creek dams in Arizona, and consulting engineering work with J. B. Girand, of Phoenix.

HERMAN A. WAGNER, consulting mining and metallurgical engineer, of Chicago, is the recipient of the American Association of Engineers' Clausen gold medal for distinguished service in behalf of the social and economic welfare of engineers. His efforts centered on increasing recognition for engineers.



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The AUSTIN-WESTERN Equipment Line-up now includes the AUSTIN Badger, fully convertible Shovel, Crane, Dragline and Trench Hoe, the new AUSTIN Bituminous Distributor, the new double spur gear drive CADET Roller in 5, 6, 7 and 8 ton sizes, the new No. 77 Full-Dual Drive Motor Grader, CLETRAC Tractors in 15, 25, 35, 55 and 80 H. P. sizes (sold in the CLETRAC AUSTIN-WESTERN territory), and a complete line of *improved* blade graders, elevating graders, crawler wagons, portable crushing, screening and washing plants, snow plows, etc.

There's a *better* AUSTIN-WESTERN Equipment for all road building, maintenance and earth moving jobs. Greater efficiency, fool-proof operation and extra years of service, even under most adverse operating conditions, are built into every unit.

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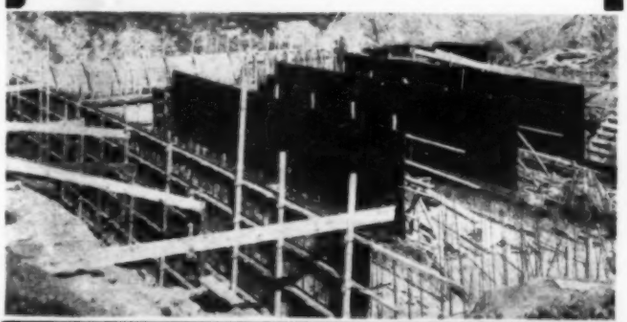
Used In Forms for This Circular Tank — Also Built the Straight Wall Forms For This Rectangular tank



Forms for round concrete water-tight tanks of large diameter are built with standard straight Metaforms — steel form units — at costs that show considerable saving over any other method of form construction. And the same Metaforms would be used in building forms for hundreds of other straight wall or large diameter circular jobs during their years of working life.

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Metal Forms Corporation

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. . . It delivers good air to your men at all times under every condition, thus increasing their efficiency and production.

. . . It will deliver as much air as any tubing. Has a patent coupling that prevents loss of air at joints.

. . . It is economical—low in installation and maintenance costs. Can be used again and again.

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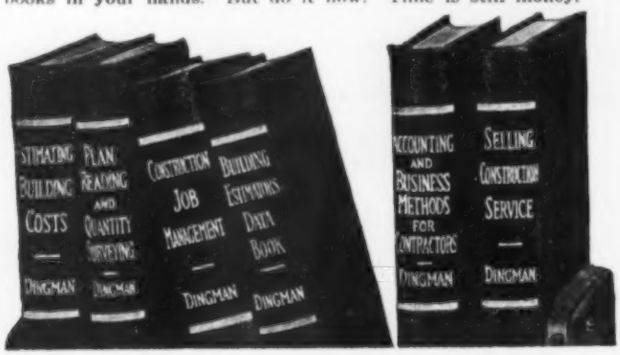

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[2] The young men in the building industry who intend to make the business of construction their life work, and who want the kind of guidance that will aid them to climb to the top.

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Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

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LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Construction Methods, published monthly at New York, N. Y., for Oct. 1, 1932.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared C. H. Thompson, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Construction Methods, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42d St., N. Y. C. Editor Robert K. Tomlin, 330 West 42d St., N. Y. C. Managing Editor, None. Business Manager, Willard Chevalier, 330 West 42d St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42d St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42d St., N. Y. C. James H. McGraw, Jr., 330 West 42d St., N. Y. C. James H. McGraw, James McGraw, Jr., and Malcolm Muir, 330 West 42d St., N. Y. C. Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, Curtis W. McGraw, 330 West 42d St., N. Y. C. Donald C. McGraw, 330 West 42d St., N. Y. C. Anne Hugus Britton, 330 West 42d St., N. Y. C. Mason Britton, 330 West 42d St., N. Y. C. Edgar Kobak, 330 West 42d St., N. Y. C. Grace W. Mehren, 33 West Grand Ave., Chicago, Ill. J. Malcolm Muir and Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 524 Fifth Ave., N. Y. C. F. S. Weatherby, 271 Clinton Road, Brookline, Mass. Midwood Corporation, Madison, N. J. Stockholders of which are: Edwin S. Wilsey, Madison, N. J. Elsa M. Wilsey, Madison, N. J.

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4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.)

C. H. THOMPSON, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.
Sworn to and subscribed before me this 29th day of September, 1932.

[SEAL] H. B. BEIRNE,
Notary Public N. Y. Co. Clk's No. 203, Reg. No. 3B102. Kings Co. Clk's No. 636, Reg. No. 3129.
(My Commission expires March 30, 1933)

ALPHABETICAL INDEX TO ADVERTISERS

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